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SPECIAL ISSUE
Internet-of-Things

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ARM or x86?

Qseven modules for LPWAN gateways

Making the Internet of Things sm and power-efficient

The Internet of Things (IoT) has become one of the most important technology trends of recent years. Intelligent devices are interconnected and Artificial Intelligence (AI) algorithms are being used to process the vast amounts of sensor data that is being produced. This exciting marriage of IoT and AI requires state-of-the-art sensors, security, and power delivery to make it all possible.

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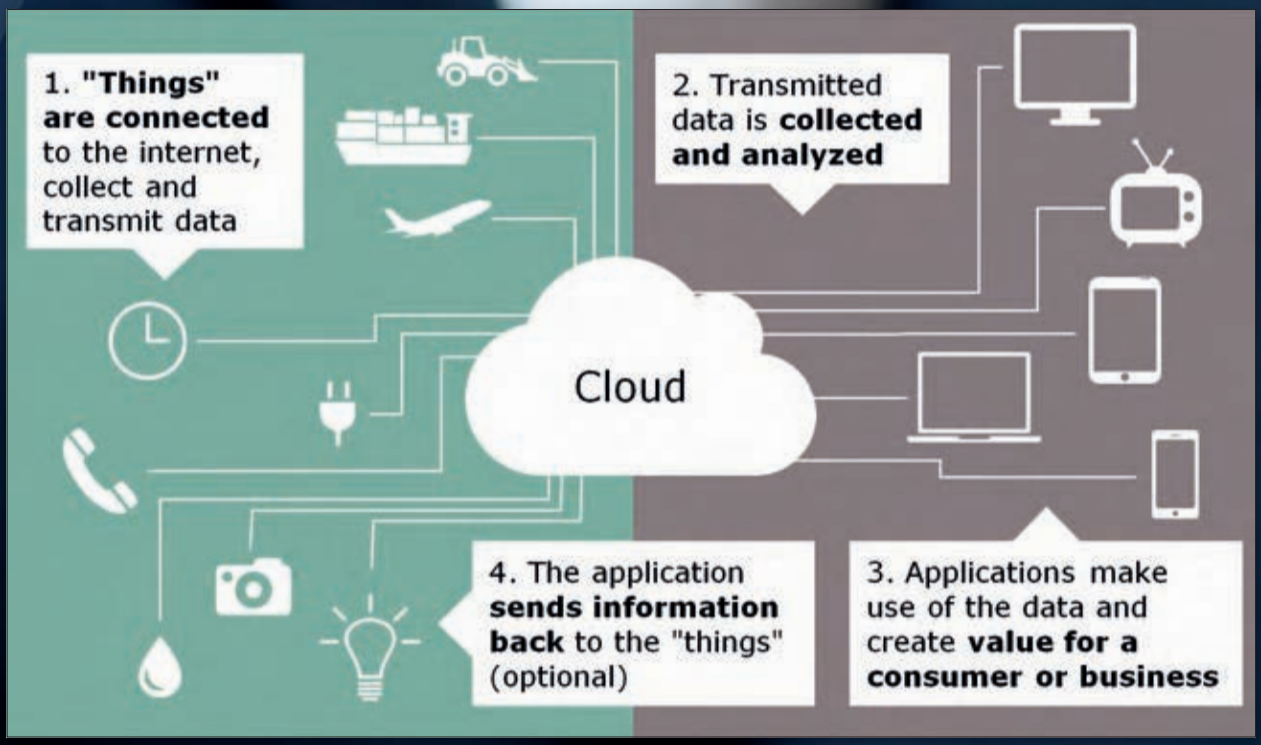


There are many varying definitions and opinions of just exactly what IoT is and how it is related to AI. When you filter through all of the details, you end up with a simple, basic explanation. IoT is the networking of cyber-physical objects that contain embedded electronics to sense, compute, actuate, and communicate. The AI in IoT devices processes the sensor data from the embedded electronics, analyzes it, and attempts to understand the surrounding environment and events.

Read more in the article starting on page 8.

Dear Readers,

Just a few weeks ago Hannover Messe demonstrated the ubiquity of the Internet of Things (IoT) in the industry – called industrial IoT or especially in Germany Industrie 4.0 or nowadays Digitalization. In traditional production environments, machines, manufacturing execution systems (MES), and ERP systems are separate from each other. Digitization is changing this; connected processes are the central to the new age of industry. The classic, rigid automation pyramid is becoming a network of independent and yet connected components. Data flows seamlessly between machines and the MES or ERP system, uniting the business and manufacturing sides of the operation. Connected manufacturing allows companies to automate highly complex production processes. So even for customized products, the whole supply chain – from order to assembly to after-sales support – practically takes care of itself. In this way, manufacturing one-off items becomes as financially viable as mass producing them.

And IIoT will change the way how plants and systems are serviced. In the old days, a production plant had to break down before it could be repaired. Today intelligent systems recognize faults before they appear. Predictive Maintenance can make enormous cost-savings and open the way to new business models. And there are already real examples. At Havøygavlen, the world's most northerly wind farm , some 100 kilometers from the North Cape, 15 wind turbines produce 90 million kilowatt-hours of electricity per year. With the help of the Internet of Things, the turbines, rotors, transformers and other components continuously transmit sensor data to the Arctic Wind control center to support a predictive maintenance approach. Combining this with weather data, tidal and other information, software from SAP creates a virtual portrayal of the Havøygavlen facility, rendering physical inspection almost obsolete. The solution takes into account complex forces that impact the system, and determines both the direct effects of one-time events and the long-term consequences of cyclical strains. This means significantly lower maintenance costs for the operator – and fewer icy outings under inhospitable polar nighttime conditions for technicians.

The IIoT will also enable so called Integrated Energy provided by existing and new market players. Power is no longer generated only in conventional power stations, but also in many industrial processes and private households – consumers are becoming energy suppliers, and vice versa. How is the market developing in this age of decentralised power generation? Wind turbines are expected to play a key role in providing a reliable source of energy across Germany. Software is an important component in that process.

And these examples are just the tip of the iceberg – IOT will in future influence the daily life of all of us. In the meantime, you´ll find information about new developments in IoT in this special issue of ECE/B&S to keep you up to date. Enjoy!

Yours Sincerely

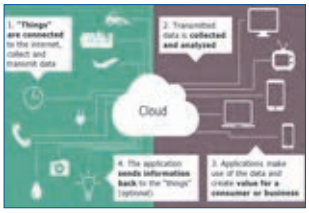
Wolfgang Patelay
Editor

Cover Photo:
congatec

ARM or x86? Qseven modules for LPWAN gateways Page 6

The FlexGate Low-Power Wide-Area Network (LPWAN) gateway from the French IoT and embedded systems engineering specialists EXPEMB is based on Qseven Computer-on-Modules from congatec. This gives the vendor the freedom to pick any ARM or x86 low power processor customers demand.

Making the Internet of Things smart, secure, and power-efficient Page 8



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New connectivity protocols for small IoT devices Page 12

The most popular of the new connectivity protocols for small IoT devices are MQTT, CoAP, LWM2M and 6LoWPAN. This article gives some information on each of these, and a comparison of their differences and relative merits.

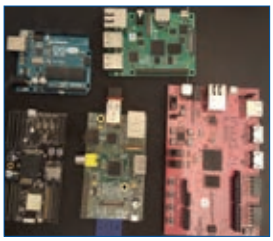
Why device management in the IoT matters and how to achieve it Page 22

This article outlines the business case for efficient device management and introduces a solution for managing edge devices remotely, reliably, and cost-effectively.

COM Express Type 6 as basement for visual solutions Page 24

This article highlights how the providers of visual solutions can focus on the control technology of display solutions and embedded computing design in order to realize state of the art customer-specific solutions.

The All Programmable SoC enters the maker arena Page 32



The maker sphere provides both a popular hobby for many and an inspiration for young people to follow careers in science, technology, engineering and math subjects. Many of the projects within this sphere contain an embedded processor, commonly a member of the Arduino or Raspberry PI families, to provide the intelligence required.

ARM or x86? Qseven modules for LPWAN gateways

By Zeljko Loncaric, congatec

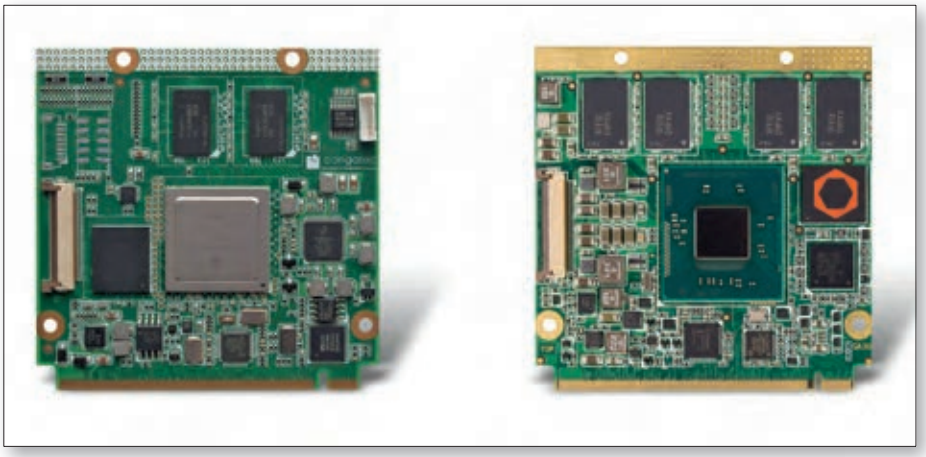
The FlexGate Low-Power Wide-Area Network (LPWAN) gateway from the French IoT and embedded systems engineering specialists EXPEMB is based on Qseven Computer-on-Modules from congatec. This gives the vendor the freedom to pick any ARM or x86 low power processor customers demand.

Connected distributed sensor and controller networks for monitoring, management and maintenance purposes are the driver behind the IoT. One of the major challenges is providing reliable connectivity and data exchange with distributed sensors and controllers over long distances from a few hundred meters up to several kilometers. This challenge is twofold: To meet the ultra-low power consumption requirements of the distributed sensors and controllers while enabling reliable and cost-efficient data exchange. Local wireless technologies don't have the broadcast range. Cellular technologies are too expensive and consume too much energy. Thus, new technologies are needed for these Low-Power Wide-Area (LPWA) connections in rural as well as urban areas that are major drivers of the progressive high growth rates of M2M and IoT applications.

While the total number of M2M connections will only grow from 5 billion in 2014 to 27 billion in 2024 at a CAGR of 18%, LPWA is a market that is expected to grow at 93% CAGR during 2016-2022 to reach 14% of the overall M2M connections in 2024. Today, Western Europe has the largest share of the LPWA market as the countries in this region were early adopters of these information systems. But major smart city projects in China, Singapore and India are also driving the growth. LPWA connections can be made available via different technologies. One path is based on a cellular type infrastructure with telecom like base stations. Examples are Sigfox or Huawei (Cellular IoT) which get deployed as open networks for usage of everybody. But most commercial users prefer private networks due to security concerns. One of the technologies for this market segment is LoRa. It uses a star topology for a bi-directional connection between devices like sensors or actuators, and one or several gateways that can – if supported –immediately forward all data via standard IP technology to a central cloud server. The data rate between the devices and gateways ranges from 0.3 kbps to 50 kbps. LoRa also encrypts all data via AES encryption technology by using a 64 bit unique network key, a 64 bit unique application key and a 128 bit device specific key. The single-hop wireless connection uses the unlicensed 868 MHz frequency band in Europe and 915 MHz in North America. By this, operators do not have to pay for third party infrastructures and licenses, which help to reduce cost.

The maximum capacity of accessible end devices or nodes for a LoRa gateway depends on the number of packets the gateway has to manage in a given time frame. A LoRa building block for a gateway with 8 channels can process up to 62,500 packets per hour. This equals the maximum amount of devices a gateway can handle if it is configured to send only one packet per hour. The maximum range in urban environments with no direct line of sight and deep indoor coverage ranges from 2 to 10 km. In suburban areas, up to 15 km can be achieved and 40 km for areas with a direct line of sight and little interferences.

To balance battery life and signal strength, the LoRa network server uses an Adaptive Data Rate (ADR) algorithm to automatically define the optimal performance under the local environmental conditions. The algorithm is based on advanced information such as Signal Noise Ratio (SNR), Received Signal Strength Indication (RSSI) and different channels to optimize signal strength and power consumption for each end device individually. By this, end devices can achieve a battery life of up to 105 months with a 2000 mAh battery, which is about 10 times more than current cellular based protocols offer. Besides the technological aspects, LoRa also receives great industry support, which helps to accelerate its roll out across the world. In July 2016, for example, KPN made its LoRa network throughout the Netherlands available for IoT applications. LPWAN specialist Actility also supports



The QSeven modules used in the FLEXGATE gateways

LoRa. This setup makes LoRa one of the most interesting low-power wide-area network technologies for many applications. Target application areas include IoT and M2M installations in smart cities and industrial applications such as agriculture, infrastructure, utilities, and logistics.

EXPEMB has developed a modular and scalable multi-service gateway for such LoRa networks that is designed for both commercial as well as harsh industrial environments and can be deployed in various applications, from control cabinets in facilities, to substations in energy grids, to cellular base station like infrastructures for smart city and smart agriculture projects. The FlexGate gateway that is ThingPark approved by Actility includes a real LoRa concentrator structured around a dedicated Semtech SX1301 chip. It has the capability to simultaneously listen to 8 LoRa channels in order to communicate with several thousands of connected nodes. FlexGate gateways also offer rich connectivity towards the central cloud with 1Gbit Ethernet link, Wi?Fi, 3G/4G and Bluetooth. All links are simultaneously available on the gateway and fall back can be set according to different scripts. This approach ensures reliable communication regardless of the local topology.

The FLEXGATE Gateway

A broad range of field I/Os such as 2x USB ports, 1x serial port and GPIOs makes it possible to interface other local devices with wired communication in different flavors including Modbus fieldbus support. Integrating only industrial components without any moving parts such as fans or HDDs, the FlexGate gateway is a high reliability platform designed for 24/7 operation. It is powered by DC or PoE+, where the later reduces cabling efforts. Outdoor configurations support the extended temperature range and IP67 protection with associated waterproof connectors.

The FlexGate gateways are designed as application-ready platforms and offer management services based on a modular Linux framework that is dedicated to the IoT. This open architecture allows easy integration of any new services required. Services that are already part of the standard configuration include highly secured communication layers as well as an open packet forwarder that forwards RF packets received by the concentrator to a server through an IP/UDP link, and emits RF packets that are sent by the server. Beyond the extensive LoRa network support in the field, the FlexGate gateway also offers flexible cloud-to-field connectivity which is ready to adapt local LoRa configurations and to facilitate every required service needed, from field deployment services to operational monitoring and management as well as maintenance services including remote firmware upgrade (FOTA) functions. As the product line has been designed to address all various needs of LoRa gateway deployments, the system family can integrate all common processor technologies independently from the microarchitecture. This enables EXPEMB to offer its gateway technology in absolutely all customer projects that might occur one day. Because the company didn't want to limit its LoRa core competence to a certain processor technology as this would limit our market potential too much. It therefore designed a twin architecture platform capable of hosting both ARM and x86 technologies, which allows to participate in all calls for tenders.

Current FlexGate gateways are equipped with flexible processing power based on two major processor families: One is the latest generation of Freescale i.MX6 low power multi-CPU cores. The other one is the Intel Atom E3800 product family with 1 to 4 cores (code name Bay Trail). Both flexible architectures of the FlexGate portfolio offer a processing power that can easily be adapted to different use cases due to its wide performance scalability up to fog and edge server intelligence. The implemented hardware platform as well as the performance flexibility have been made possible by integrating Qseven Computer-on-Modules that support both architectures, ARM and x86.

The usage of such modules also enables EXPEMB to switch one of these processor families to the next latest state-of-the-art technology without any need to change the hardware design. This makes the FlexGate gateways a platform that can be deployed longer than the lifecycle of the processors, which is 15 years for Freescale and 7 plus years for Intel. Additionally, future processors like the next Intel Atom generation codenamed Apollo Lake can also be implemented.

From the vendor point of view, EXPEMB has chosen modules from congatec because they are leading in Computer-on-Modules in Europe and offer best in class service and support as well as one of the broadest Qseven portfolios available. And even though this company has highest market share – which could imply complicated processes to get the right support due to a huge fragmented organization – the personal integration support is what EXPEMB is most happy with.

The challenge was to get a more or less identical functional setup for the different architectures to enable to scale the solutions in the most efficient way. For this purpose, congatec provides perfect platform support to build uniform families with both x86 and ARM. Most standard Computer-on-Module vendors have dedicated experts for each architecture. Congatec had the same expert for both architectures. That made communication very efficient. ■

Making the Internet of Things smart, secure, and power-efficient

By Clayton Cornell, Infineon Technologies

In the IoT, Intelligent devices are interconnected and AI algorithms are being used to process the vast amounts of sensor data that is being produced. This exciting marriage of IoT and AI requires state-of-the-art sensors, security, and power delivery to make it all possible.

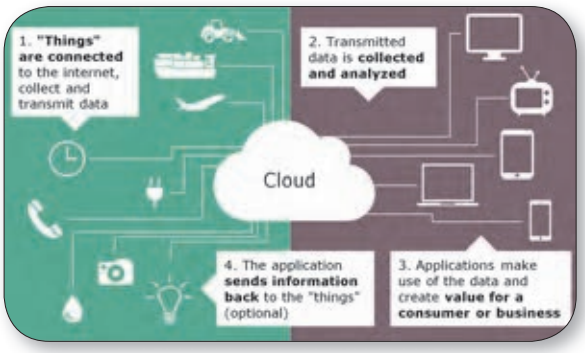


Figure 1. The Internet-of-Things and the flow of information

■ The Internet of Things (IoT) has become one of the most important technology trends of recent years. IoT devices are showing up everywhere and radically changing how we do business and interact with the world around us. Our offices, our homes, our factories, our automobiles, and the things we wear or carry in our pockets are all being equipped with embedded electronic systems, sensors, and even Artificial Intelligence (AI) software. These IoT devices that were once a science fiction dream are rapidly becoming an irreplaceable part of our daily lives.

Devices equipped with intelligent semiconductor components are forming the foundation of the smart, secure, and power efficient IoT that is developing around us. The "smartness" of these systems is achieved by stretching the boundaries of current design and technology. The intelligent devices (which were stand-alone in the past) are interconnected in ways that were not possible even a few years ago and AI algorithms are being used to process the vast amounts of sensor data that is being produced. This exciting marriage of IoT and AI requires state-of-the-art sensors, security, and power delivery to make it all possible.

IoT and AI in the real world

There are many varying definitions and opinions of just exactly what IoT is and how it is related to AI. When you filter through all of the details, you end up with a simple, basic explanation. IoT is the networking of cyber-physical objects that contain embedded electronics to sense, compute, actuate, and communicate. The AI in IoT devices processes the sensor data from the embedded electronics, analyzes it, and attempts to understand the surrounding environment and events. Given the incredible potential behind this concept, it's hardly a surprise that companies all over the world are taking steps to combine IoT and AI in new and creative ways. One interesting example is in the emerging "smart city". It is rapidly becoming apparent to city administrators that smart networked infrastructure is playing an increasingly important role in defining the world we live in. Designers are rethinking common everyday objects and adding new functionality or completely redesigning them. Out of this are coming new IoT devices such as smart street lamps. These new street lamps are evolving into a highly functional, connected, energy-efficient portal that is forming the backbone of the smart city infrastructure. It is this marriage of IoT and AI that provides street lamps that can sense approaching vehicles and brighten or dim the light accordingly. The street lamps can sense empty nearby parking places and communicate this to navigation systems in cars. These street lamps can also do things like provide E-Vehicle charge ports and even monitor and analyze the performance of the light itself and inform a central monitoring systems when they are in need of preventative maintenance. IoT Street lamps with built-in AI are not just fantasy though. This is a very real concept that has been born out of collaboration between Infineon, Intel, and a Munich based startup company, eluminocity. Street lights with this feature are already in place in various cities around the world such as Munich, Chicago, Oxford, and Eindhoven, with more installations to follow. IoT and AI is opening up new markets and even enabling markets that previously have not been possible or even imagined. The invention of the home computer, the development of the internet, the progression to cloud computing; each step along the way has paved the road to IoT. Combining IoT with AI is opening up a whole new world of possibilities.

Challenges and Solutions

While the devices themselves and the AI algorithms are key to this emerging technology, the increasing number of devices coupled with the growing power requirements and the critical need for security is presenting designers with some big challenges. The power levels required for this new AI technology for example are simply staggering. In order to match the processing power of a human brain which consumes roughly 20 Watts, an AI system would need to perform more than 38 thousand trillion operations per second (38 PFLOPS) consuming more than 15 Megawatts of power in the process. Simply delivering these levels of power is challeng-

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Figure 2. The eluminocity LED smart street lamp (source: eluminocity)

ing enough. Efficiency is absolutely critical, not only as energy costs are rising, but also as every watt of waste energy dissipated as heat increases the air conditioning requirements in the datacenter, further increasing operational costs and carbon footprint.

The networked connectivity of these IoT devices is also raising some interesting challenges. The AI systems behind the devices need to transmit vast amounts of data, and do it in a secure way that protects not only the devices themselves, but also the data. It has been estimated by Gartner that over 20 billion IoT devices (not including smartphones, tablets, and computers) will be 'connected' by 2020. Data traffic and volume is at an all-time high - driven by the machine-to-machine communications of the IoT. All of these devices also need an increasing number of sensors – radar, temperature, pressure, motion, light levels, sound, proximity, the list goes on. All of these sensors have to be integrated into a smaller and smaller space.

Given the vast array of challenges facing today's IoT designers and the AI programmers, what solutions can be considered? Infineon provides a large number of sensing devices which are perfect for use in IoT devices. Infineon's BGT24LTR11 for example is the market's smallest 24 GHz industrial radar chip solution. The BGT24LTR11 is a silicon germanium radar Monolithic Microwave Integrated Circuit (MMIC) transceiver. It operates in the 24.0GHz to 24.25GHz ISM band and it provides a very high level of measurement precision. With Infineon's 24GHz radar portfolio, one can measure various parameters including Doppler-based object speed and velocity, and electromagnetic wave based distances. Additional receiving channels allow it to detect angle and direction based upon phase detection at the antennas. 24 GHz radar technology is found in multiple applications including UAV/multicopters, service robotics, industrial robotics, security systems, smart street lighting, and many other IoT-based applications.

A sophisticated approach to power management and design is required to meet the electrical demands of IoT and AI. In order to address this, Infineon has introduced advanced digital control techniques, replacing the legacy analog-based solutions. Digital control brings many benefits when designing high-end power solutions, not least overall system flexibility and adaptability. With digital technology, controllers can be customized without the need for expensive and time-consuming silicon spins. The customization extends to defining the configuration, telemetry for gathering system performance data, setting fault management and calibrating the device. As power systems become more integrated into the overall solution, communication between the power solution and the main CPU / GPU / TPU is a new requirement. Infineon's mature digital controller technology facilitates market-leading solutions and includes a GUI that enables real-time system design, configuration, validation and monitoring.

Digital solutions simplify building the scalable power solutions required for AI. Yet with all of the included functionality and precision delivery of power, they are now price competitive with the analog solutions they are ultimately replacing. Infineon's complete portfolio includes huge breadth of products including digital controllers, integrated power stages, integrated power management ICs, Point-of-Load (POL) converters as well as discrete solutions including driver ICs, power blocks and discrete MOSFETs. The range is built upon Infineon's long history of innovation and comprises multiple market-leading technologies such as OptiMOS™, DrMOS™ and µDrMOS™.

The connectivity that provides the core of the IoT comes with some potential security vulnerabilities. Infineon's OPTIGA™ family of reliable security solutions addresses this issue and helps secure the IoT networks. These standardized security controllers provide a broad range of security functions for embedded platforms. All OPTIGA products are based on Infineon's advanced hardware security technology that gives you as a designer or end user, confidence that your data is secure and protected. Embedded security functions include system and data integrity, authentication, secured communication, secured data storage, and secure updates. Each of these functions is essential to protecting the data integrity as data is collected and analyzed by AI. The OPTIGA family, built around a 16-bit state-of-the-art security controller, is easy to integrate into a wide range of IoT systems. Support for both Microsoft Windows and Linux (and its derivatives), and integration support for proprietary systems make OPTIGA and ideal choice. The family also contains TPM devices that are the first to support the latest TPM 2.0 standard from

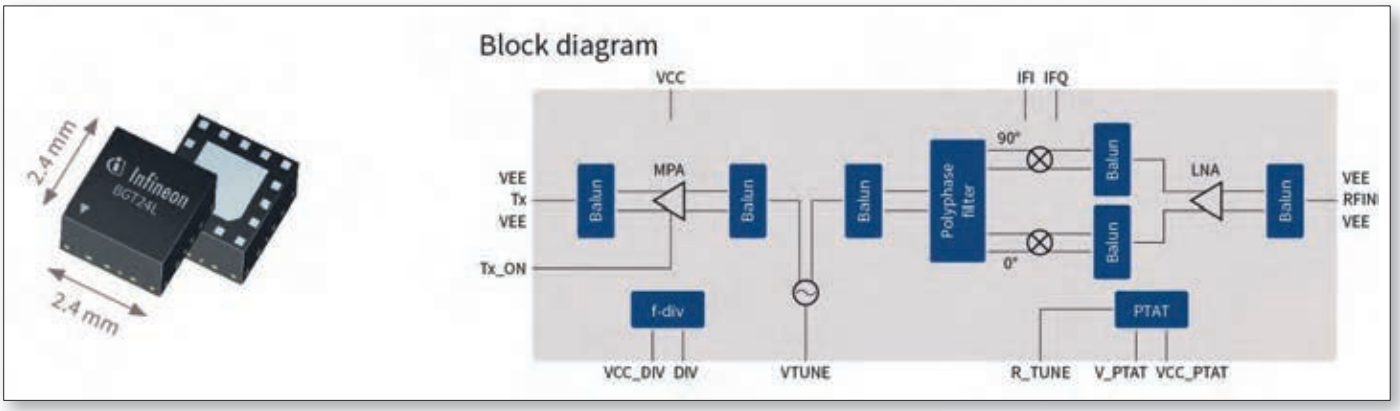


Figure 3. Block diagram and package size of the BGT24LTR11 24 GHz industrial radar chip

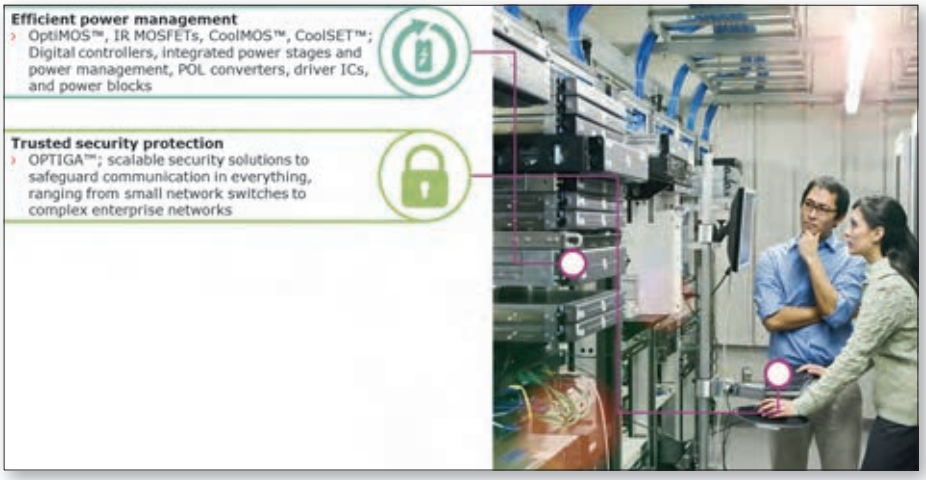


Figure 4. Efficient power management and data security

the TCG, making it easy to implement the very latest security protocols. While IoT and AI is still early in its development, it is already being recognized to be an important and rapidly growing technology trend with expected substantial impacts on the world around us. These pioneering IoT devices coupled with newly imagined AI algorithms are challenging designers on many fronts. The traditional hardware designs are rapidly migrating from their humble beginnings as stand-alone single use devices, to highly advanced smart tools that are networked together in ways that we only imagined in science fiction stories and movies. The combination of IoT and AI will reshape and redefine our lives and businesses in ways we cannot yet imagine. We cannot wait for the full impact of this change before we react. Instead, we must move forward together, developing and innovating, finding ways to secure the IoT communications, improving the power efficiency, and inventing new ways to sense the world around us. The IoT and AI revolution is on our doorstep and now is the right time to step up and prepare for it. ■

Product News

■ AAEON: all-in-a-box LoRa gateway and network server

AAEON and The Things Industries are proud to announce the all-in-one LoRa Gateway and Network Server, a comprehensive solution providing a secure, scalable and reliable LoRa routing for your valuable IoT data. LoRa is a widely used standard for Low Power & Long Range data exchange and it's expanding quickly through open network LoRaWAN and private networks built for industrial applications.

News ID 5123

■ Express Logic: industrial-grade IoT device-to-cloud connectivity platform

Express Logic announced the X-Ware IoT Platform, for fast, safe, secure, industrial-grade connectivity of deeply embedded IoT sensors, devices, edge routers, and gateways. The X-Ware IoT Platform is built on top of Express Logic's high-performance ThreadX RTOS and NetX Duo dual IPv4/IPv6 TCP/IP stack. The X-Ware IoT Platform leverages all the benefits of NetX Duo and introduces new IoT protocol support for IPv6 over Low Power Wireless Personal Area Networks, Message Queue Telemetry Transport, Constrained Application Protocol and Lightweight M2M.

News ID 5131

■ Gemalto: HSM enables Microsoft Azure Information Protection

Gemalto announced that Microsoft Azure Information Protection customers can now take advantage of the new "Hold Your Own Key" (HYOK) functionality using Gemalto's SafeNet Luna Hardware Security Modules (HSMs). The integration allows organizations in highly regulated scenarios to manage, own and store their encryption keys in on-premises HSMs and securely share data with complete control over their keys.

News ID 5155

■ Portwell releases highly composable IoT gateway

Portwell announces XM-1, the first IoT gateway to feature international patents of highly composable structure. XM-1 satisfies customers' requests for an IoT gateway solution that can meet the requirements emerging from an extensive range of IoT applications. Due to local/specific infrastructural challenges - such as transmission distance, geological obstacles, limitation of regulation and/or power consumption - a system integrator involved in a wide variety of IoT projects might need to deploy a gateway solution.

News ID 5219

New connectivity protocols for small IoT devices

By Michael May, Express Logic

The most popular of the new connectivity protocols for small IoT devices are MQTT, CoAP, LWM2M and 6LoWPAN. This article gives some information on each of these, and a comparison of their differences and relative merits.

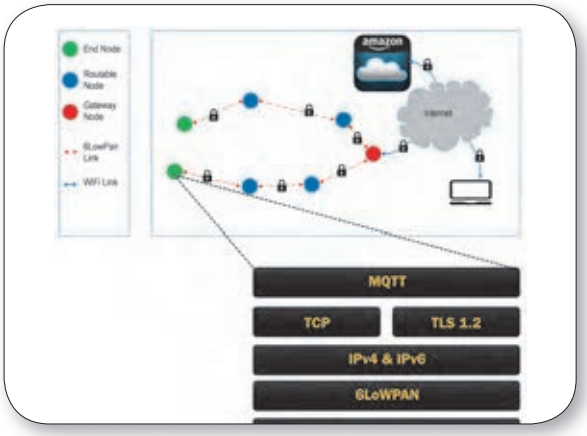


Figure 1. MQTT is a publish/subscribe-messaging protocol designed for lightweight machine-to-machine (M2M) connections.

■ The expansion of the Internet of Things (IoT) to incorporate small devices is projected to incorporate tens of billions of things by 2020. That's an enormous number of devices, and each one of them is a source or a consumer of tons of data. The worldwide deployment of smart meters is expected to reach 131 million by 2018, primarily in residential settings. Those meters measure and report on electricity used 24/7, providing daily, even hourly reporting. And that's just smart meters. Think of home thermostats, surveillance cameras, traffic signals, and all the other things that gather data and send it to the cloud for analysis and additional processing to better support consumer needs.

As exciting as these opportunities are, the Internet was not designed to accommodate this many nodes with a 32-bit field for device addresses. Fortunately, in 1994 the Internet Engineering Task Force (IETF) anticipated the need for more IP addresses and initiated the development of a suite of protocols and standards now known as Internet Protocol Version 6 (IPv6). IPv6 uses a 128-bit address size compared with the 32-bit system used in IPv4, and allows for as many as 3.4x1038 possible addresses.

The expansion of the IoT and the new small devices that are fuelling its expansion, however, require more than just addressability. Many of these devices have small memory, inexpensive CPUs, are battery-powered, yet require real-time responsiveness. Today, we have the hardware technology to create these devices, and small-footprint real-time operating systems (RTOSes) to manage their internal system functions, but common TCP/IP network software protocols are hard-pressed to support them. To address these limitations, a number of new connectivity protocols have been developed. These protocols are intended today for use on resource-constrained, low-end microcontroller-driven, battery-powered IoT devices. The goal is to enable these things

MQTT/CoAP Comparison

MQTT	CoAP
Requires TCP, which is larger than UDP, making MQTT not as small as CoAP.	Runs on UDP and thus can be run on extremely resource-constrained environments.
Offers publish/subscribe semantics (on the same socket) which makes it easier to program on the IoT device side. IoT cloud service providers such as AWS IoT and Everything and others offer MQTT-based device connectivity.	Is a good mechanism for local network communication, particularly when there is an ecosystem of other CoAP devices.
Requires a message broker (server) for its functioning. This makes it a good option for remote/cloud communication, since the cloud server acts as the message broker between the IoT device and other app/services. This also makes it not a great option for local network communication between devices, because it requires the end-user to deploy an additional broker in the system.	

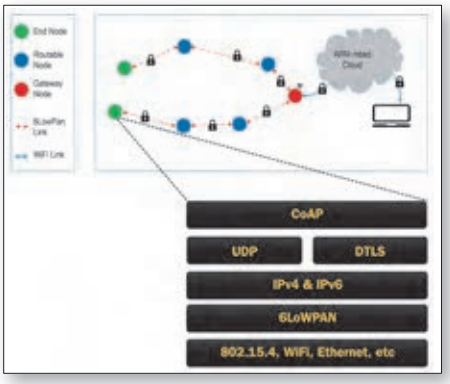


Figure 2. Express Logic has implemented the Internet-of-Things protocols (CoAP, UDP, IPv6, and 6LoWPAN) in just 25KB of code. This configuration supports a device end-node, with limited IPv6 and 6LoWPAN functionality. The 25KB code size does not include the ThreadX RTOS (6KB) nor the optional DTLS (5KB), or any application code. It represents only the code necessary for the cloud communication.

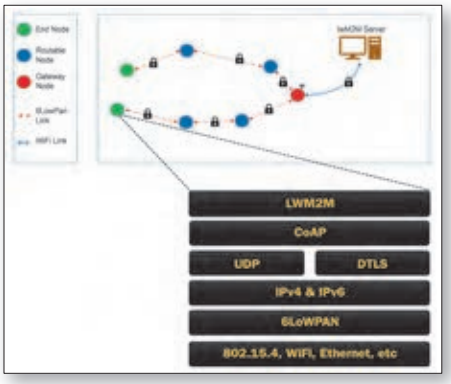


Figure 3. With LWM2M, the end-node application's interface to Amazon AWS, for example, is through the CoAP protocol. Messages will go from LwM2M to CoAP, through UDP, TLS/DTLS, and IPv6. If Ethernet is the physical transport path for the device, the IPv6 packet goes out directly via the Ethernet driver. If 802.15.4 is the physical transport path of the device, the message is sent out over 6LoWPAN and the 802.15.4 driver.

to communicate with each other, with the Internet, and with the cloud. In some cases, multiple protocols are available for similar functionality, and the choice of the best one is dependent on the application. The good news is that many protocols are available from many software and system vendors. The bad news is that not all of the implementations are industrial grade. That is: ready for mass market distribution, developed for reliable, long-term IoT performance, and implemented in a format that meets demanding design requirements. This is the IP stack challenge, which IoT developers must understand and anticipate in order to make the right protocol decisions for each product design. The most popular of the new connectivity protocols for small devices are MQTT, CoAP, LWM2M and 6LoWPAN. Here is some information on each of these, and a comparison of their differences and relative merits.

MQ Telemetry Transport (MQTT) is a publish/subscribe-messaging protocol designed for lightweight machine-to-machine (M2M) connections with remote locations where a small code footprint is required, or the network bandwidth is limited. It was originally developed by IBM and is now an open standard. MQTT employs a client/server model, where every sensor end node is a client and connects to a server, known as a broker, over TCP through routable nodes and/or a gateway. The broker might be a cloud service provided by a vehicle manufacturer, for example or a general-purpose supplier such as Amazon. The publisher-subscriber model allows MQTT clients to communicate one-to-one, one-to-many, and many-to-one. Even though MQTT is designed to be lightweight, it has two drawbacks for very constrained devices.

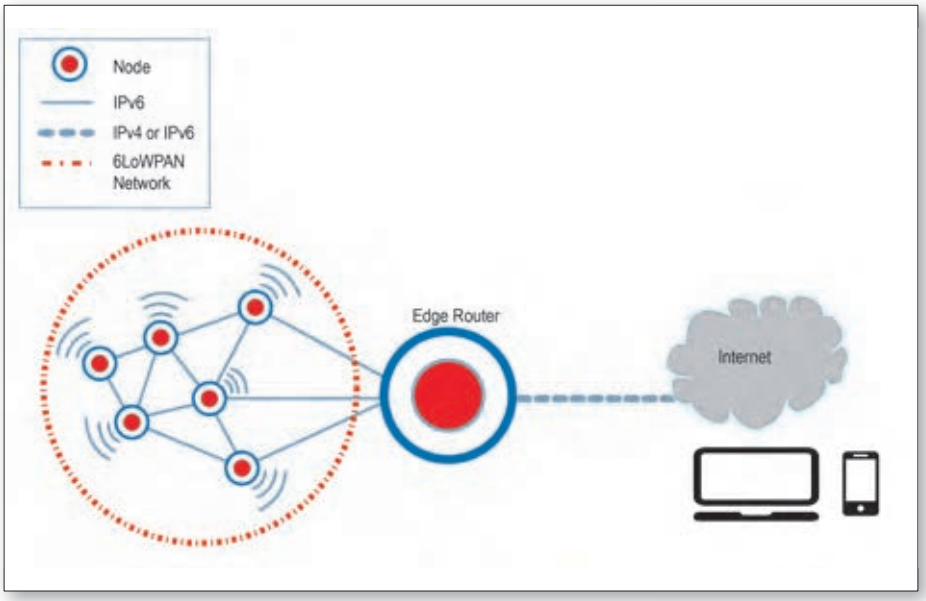


Figure 4. 6LoWPAN is a mesh network protocol, allowing IPv6 datagrams to be transmitted by low-power short-range radio (such as IEEE 802.15.4).

1) Every MQTT client must support TCP and will typically hold a connection open to the broker at all times. For some environments where packet loss is high or computing resources are scarce, this is a problem. 2) MQTT topic names are often long strings which make them impractical for 802.15.4 (low-power, low-speed wireless radio). Both of these shortcomings are addressed by the MQTT-SN protocol, which defines a UDP mapping of MQTT and adds broker support for indexing topic names.

Constrained Application Protocol (CoAP) enables constrained devices to communicate with the Internet using similar protocols. CoAP is designed for use between devices on the same constrained network, between devices and general nodes on the Internet, and between devices on different constrained networks, joined by an Internet. CoAP is designed to easily translate to HTTP for simplified integration with the web, while also meeting specialized requirements such as multicast support, very low overhead, and simplicity. Unlike MQTT, which requires TCP, CoAP uses the smaller and simpler UDP, which is extremely important for resource-constrained IoT devices.

Lightweight M2M (LwM2M) is an open industry protocol from the Open Mobile Alliance (OMA), built to provide a lightweight, low-cost means to remotely perform service enablement and application management for IoT embedded devices and connected appliances over wireless connections. It is a communication protocol for use between client software on an M2M device and server software on a M2M management and service platform. LWM2M was designed to overcome issues from technical fragmentation, find a suitable mechanism to cater to the needs of constrained M2M devices, and to generate benefits from decoupling system components via standardized interfaces. The LWM2M protocol has four main characteristics: Its architectural design is based on a representational state transfer application protocol interface, it defines a resource and data model, it has been designed with performance and the constraints of M2M devices in mind, and it reuses and builds on the constrained application protocol secure data transfer standard that has been standardized by the IETF as a variation of the internet HTTP protocol (appropriate for data transfer to and from low-cost connected IoT devices).

6LoWPAN is an acronym of IPv6 over Low Power Wireless Personal Area Networks. The 6LoWPAN concept originated from the idea that the Internet Protocol could and should be applied even to the smallest devices, and that low-power devices with limited processing capabilities should be able to participate in the IoT. 6LoWPAN is a mesh network protocol, allowing IPv6 datagrams to be transmitted by low-power, short-range radio such as IEEE 802.15.4. A low-power radio typically has a range of 30 feet, with low bandwidth (in the kilobits per second range), and small packet size (128 bytes). 6LoWPAN bridges IPv6 and the low-power radio network. 6LoWPAN provides: Open standards including TCP, UDP, HTTP, COAP, MQTT, and websockets, end-to-end IPv6 addressable nodes, no need for a gateway or proxy (a 6LoWPAN border router connects the 6LoWPAN network to the Internet), one-to-many and many-to-one routing, robustness and scalability, use across multiple communications platforms (i.e., Ethernet/Wi-Fi/802.15.4/Sub-1GHz ISM), as well as interoperability at the IP level.

Each of the protocols described relies on an underlying IP stack for IPv6 communication. The new protocols are designed at the application level (except for 6LoWPAN), without regard for the means of transport (i.e., Ethernet, WiFi, or cellular). As such, much of the heavy lifting is relegated to the IP stack, which as it turns out is significantly larger than the cloud protocols themselves. It's not surprising, then, that the underlying IP stack is much more complex, and much more critical to the exchange of information, even though it is more general in design, and not specifically tailored for the cloud. When choosing cloud protocols, it is equally critical - if not more so - to select the right IP stack on which these cloud protocols will rely for proper and efficient operation.

There are various requirements for an industrial grade IP stack. Of course, the IP stack must support the IPv6 protocol. Ideally, this support should be validated and certified by an independent authority. Beyond that, the cloud protocols must be tightly integrated with the IP stack to assure efficiency and correctness of operation under all demanding use cases. The IP stack must be industrial-grade and ready for production use, and must be small, safe, secure, advanced, fast, and easy-to-use.

Figure 5. X-Ware IoT Platform is built on top of Express Logic high-performance ThreadX RTOS and NetX Duo dual IPv4/IPv6 TCP/IP stack. The industrial-grade platform adds new IoT protocol support including 6LoWPAN, MQTT, CoAP, and LWM2M for securely connecting the smallest of IoT devices to the cloud.

It would be of no ultimate benefit for a cloud protocol to be small in size so it could fit within the memory constraints of a low-cost microcontroller if the underlying IP stack were too big itself. The IP stack must be small as well, so as not to interfere with the goal of the small cloud protocol. The IP stack should also satisfy popular safety standards for electronic device software, including IEC 61508 SIL 4, IEC 62304 Class C, ISO 26262 ASIL D, UL/IEC 60730, UL/IEC 60335, UL 1998, and EN 50128 SW-SIL 4. This assures its ability to be certified for use in safety-critical systems, as well as being beneficial for use in other systems. The IP stack should be closed - with external access defined by the application, not the stack itself. It should also support security protocols such as IPsec, TLS, SSL, and DTLS. The IP stack should offer advanced technology, such as the ability to communicate with IPv4 as well as IPv6, hardware checksum support where available, and support for optional application protocols beyond the cloud such as AutoIP, DHCP, DNS, and mDNS.

Performance and efficiency of the IP stack is critical to its mission. It must be able to operate at near wire-speed - the theoretical maximum of the transport hardware - lest it introduce overhead that interferes with its mission. It must also be designed from the ground up for ease of use - with an intuitive API and clean, clear source code - to help developers get products to market faster than less-capable stacks. The IoT is exciting, both for consumers and for vendors of technology that enables the design and development of the kinds of products that consumers want. The new cloud protocols extend the IoT from device to cloud, and are best-suited for use with small-memory, limited-performance microcontrollers. To do so, the cloud protocols must be implemented in a small, efficient fashion, and importantly, must be designed for use on top of a capable, small, fast IP stack. Designers must make a careful evaluation of the underlying IP stack before committing to any cloud-only solution. ■

Product News

■ Artila: RIO-2010BM to connect sensor data to IBM Watson IoT

Artila Electronics releases the new FreeRTOS based, IBM Bluemix ready remote I/O module, RIO-2010BM, which is powered by a 32-bit NXP LPC1768 100MHz ARM Cortex M3 processor and equipped with 64KB SRAM 512KB Flash. The low-power ARM cortex M3 plus the high-efficient FreeRTOS make RIO-2010BM an ideal lightweight computing platform for device networking and remote monitoring.

News ID 5134

■ congatec premiers Cloud API for IoT gateways and IoT edge servers

congatec's new Cloud API for IoT Gateways communicates with local smart sensors, processes and converts the acquired data and executes automated actions based on a local rule engine, reducing traffic to the IoT cloud and enabling fast local actions. Secure bidirectional data exchange with any suitable clouds is achieved by using the TLS secured MQTT protocol. The best practice design solution utilizes the Microsoft Azure cloud.

News ID 5125

■ Advantech: WISE-PaaS Marketplace to enable IoT Edge Intelligence

Advantech is collaborating with ARM, Microsoft, Intel Security and Acronis on a new sharing platform–WISE-PaaS Marketplace. It creates a new business model that enables customers to create diverse IoT software/cloud solutions easily and quickly within a collaborative software ecosystem for business growth and service innovation.

News ID 5143

■ ARM: connected buildings with mbed OS 5.4

The latest release of mbed OS 5.4, delivers new features to enable developers to tackle some of the key challenges they're facing in applications such as connected buildings. Further, the transformation is in motion in IoT in 2017: New networks and connectivity coming to wide-scale deployments are a major visible signature of this change.

News ID 5101

■ Würth Elektronik eiSos and IDT sponsor Wireless Power Contest

Würth Elektronik eiSos congratulates the winners of the Open Electronics Wireless Power Contest. Over 300 ideas were entered by talented young electronic specialists and hobbyists. The participants with the most promising concepts were provided with a wireless power developer set by Futura Elettronica, the operator of open-electronics.org, to help them realize their ideas.

News ID 5227

■ Arrow launches MAX1000 FPGA IoT Maker Board

Arrow Electronics has introduced a new FPGA IoT Maker Board that has been designed for end-to-end application development and optimised for cost. The Arrow MAX1000 board can be installed directly into a custom application or integrated on to a completely separate board. It has been created for start-ups, universities or established equipment manufacturers who want a flexible, low cost FPGA platform for development. Arrow can also supply customised variants.

News ID 5160

■ Wind River: software virtualization platform for control systems

Wind River is advancing Industrial IoT with availability of a software virtualization platform enabling critical infrastructure companies to cost-effectively evolve aging legacy control systems not previously designed to support the connected nature of IoT. Wind River Titanium Control empowers the next generation of on-premise analytics to optimize industrial processes.

News ID 5110

■ Premier Farnell launch tinyTILE for wearables and IoT market

Farnell element14 launch tinyTILE, an Intel Curie module based board that has been created in partnership with Intel. tinyTILE is a new low power board offering features that are ideal for "always-on" applications, such as social media, sports and fitness activities, as it enables quick and easy identification of action and motions.

News ID 5099

■ Mouser partners with Renesas to reach global IoT marketplaces

Mouser Electronics announced a new global distribution partnership with Renesas Electronics Corporation, a leading supplier of advanced semiconductor solutions. Launching the relationship at Embedded World, Mouser and Renesas will focus availability on the latest software, development kits, and microcontrollers that comprise the groundbreaking Renesas Synergy Platform.

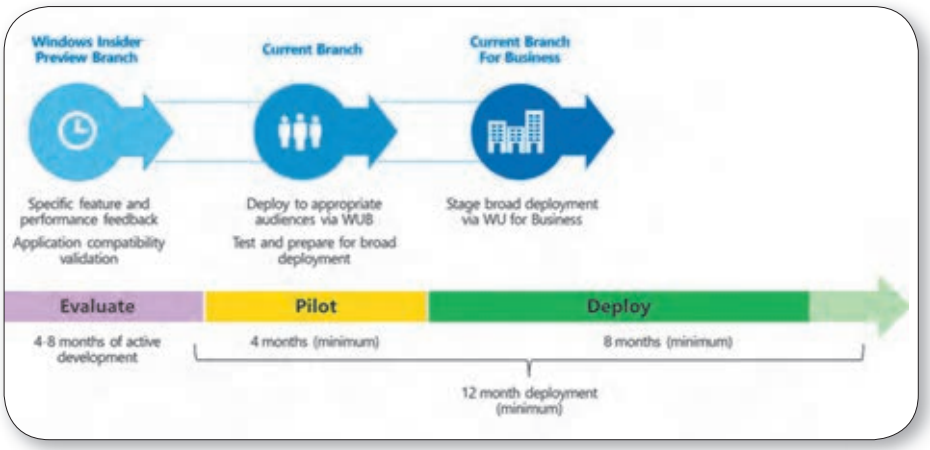
News ID 5109

More information about each news is available on www.Embedded-Control-Europe.com/magazine You just have to type in the "News ID". —

Avoiding frustration and saving costs with Windows 10 IoT Enterprise

By Patrik Hellmüller, Syslogic

Constant updates for the operating system annoy many home users and cause real discontent in the industry. Windows 10 IoT Enterprise gives you control of the update, provided you opt for the correct version. This article explains how to find out which one that is, and why you will even save on licensing costs.



In the Long Term Servicing Branch (LTSB) version, new versions are provided as an update only every two to three years. These updates include new Windows features, which are already used with the Current Branch and Current Branch for Business versions and have therefore already been put through their paces.

■ Microsoft is taking a big step forward in the industry with the Windows 10 IoT operating system presented in 2015. While Microsoft dominates the home user market, many users rely on Linux systems in industry, especially in mechanical engineering and in industrial automation. And these are precisely the users Microsoft wants to win for themselves. The company has come up with a lot in order to be successful here, and so that industrial customers will be satisfied in the long term. In this article we will limit ourselves to Windows 10 IoT Enterprise.

One annoyance for many industrial users is constant updates for the operating system. Functional updates often cause compatibility problems. This in turn can cause downtimes in production as well as failures, frustration and anger. At the same time, the need for security increases. Industrial users also want the assurance that the version they are using does not have any security vulnerabilities. However, regular updates are necessary precisely to prevent such vulnerabilities. In the Long Term Servicing Branch (LTSB) version, new versions are provided as an update only every two to three years. These updates include new Windows features which are already used with the Current Branch and Current Branch for Business versions, and have therefore already been put through their paces.

Microsoft has recognized this conflict of interest and is offering industrial customers a solution. This consists of the LTSB version (Long Term Servicing Branch) of Windows 10 IoT Enterprise. The LTSB version was developed specifically for industrial applications. It suffices with releases in a cycle of two to three years. These only contain functions that have already been tested and whose development is completed. In order to ensure that no security gaps result from the long update cycles, security updates and hotfixes are also continuously installed with the LTSB version. The operating system remains virtually untouched for a long period of time, however, since these are functional updates and not security-related updates. Any problems caused by functional updates (releases) are thus prevented. Generally you can say that the LTSB version of Windows 10 IoT Enterprise offers a much higher level of control of updates compared to all previous products. For customers from industrial automation or from mechanical engineering this is an important criterion, since in the past automatic updates always created compatibility issues.

Another good reason for Windows 10 IoT Enterprise is the pricing policy of Microsoft. Compared to Windows Embedded, the licenses for Windows 10 IoT are considerably cheaper. This is because Microsoft makes the license costs dependent on the processing power of the hardware. Since Syslogic only uses processors with low power loss for its fanless embedded systems, the entry license from Windows 10 IoT Enterprise suffices. While a license of the predecessor product Windows Embedded Standard 7 cost around 110 USD, the entry license for Windows 10 IoT Enterprise can be had for about half. The license costs for Syslogic embedded systems are also half. ■

Embedded Cloud: close to the factory floor, fast and secure

By Norbert Hauser, Kontron

In this article, Kontron and its partner S&T introduce their Embedded Cloud concept, a new cloud class designed to advance Industry 4.0 applications.

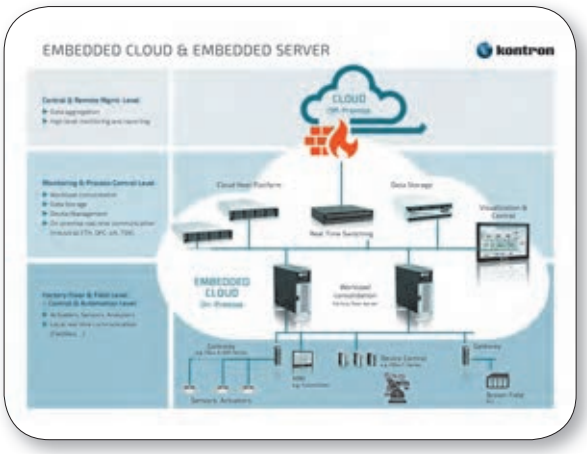


Figure 1. The Embedded Cloud serves as on-premise foundation for the IIoT and Industry 4.0 applications.

■ Kontron's Embedded Cloud is specifically geared towards the Smart Factory directly addressing IIoT needs. The goal is to optimize the production process through real-time analysis of all data available in the company. This requires building a secure cloud that is close to the factory floor, with components that reliably meet industrial needs. Devices that are used in industrial environments have to be extremely robust. They have to withstand the rigors of the factory floor: sudden changes in temperature, constant shocks and gruelling vibrations. Devices that cannot meet these criteria are not able to deliver and process all data produced in an Industry 4.0 context reliably. Absolute reliability, however, is key in the Industrial Internet of Things (IIoT) and in industrial production in general. Manufacturing companies can only keep up with this technological revolution and with their competitors from around the globe if they can confidently rely on all devices linked to the production process.

Collecting data has become commonplace in many company divisions. Data originates from CAD or Product Lifecycle Management (PLM) systems, internal databases Enterprise Resource Planning (ERP) applications, or shop floor devices. A company, however, will not gain much additional value from isolated data. Eliminating data silos and bringing everything together is the real challenge today, discovering new insights from analyzing the bigger picture of the primary objective. This is the only viable way for companies to realize their full potential in a connected factory environment.

In an ideal scenario, all existing and newly created company data can be connected and analyzed as a whole. The IT systems involved in this have to meet high real-time and security requirements. Transferring data to an external private or even public cloud is usually not feasible and, for security reasons, not always advisable. USPs and cutting edge technology are quickly obsolete once production data, sales forecasts, spec sheets or blue prints fall into wrong hands. This is why on-premise systems involved in production are joined together to form the so-called Embedded Cloud in which IT (Information Technology) and OT (Operational Technology) applications are brought together. An Embedded Cloud as imagined by Kontron comprises three device classes interconnected via network. Industrial computer platforms for device control and gateway functions: these handle measurement and control tasks on-site. For these purposes, they typically use proprietary interfaces to connect to on-site peripheral devices and sensors. These devices are connected to the Embedded Cloud via real-time data communication, e.g. via Industrial Ethernet. High-performance industrial computer platforms for edge and fog computing: with a typical performance of four to eight CPU cores and a storage capacity of several terabytes (TB), these high-performing platforms handle on-site machine management including imaging systems with various GPGPUs. Embedded Cloud Server: with a typical computing power of more than 16 cores and a storage capacity of more than 100 TB, these cloud storage servers handle machine data coordination for a whole site.

Embedded Cloud is an innovative concept, a new market segment. At the moment, only two types of companies cater to potential customers. Neither, regardless of their origin in either classic IT or automation technology, offers a truly comprehensive and balanced solution. Both supplier types address only parts of the Embedded Cloud, and thus only cover parts of the solution. The practical consequence for OEMs or end customers is a host of partners: one to discuss industrial servers, one for the real-time transfer of production data into the Embedded Cloud, and another one responsible for machine control computers. It is then up to the customer to bring their suppliers together in order to develop a harmonious combination. This is, of course, a very complex and costly endeavour which only rarely produces the desired result.

Figure 2. High-performance industrial computer platform for edge and fog computing

In direct contrast to this, Kontron, together with its partner S&T, covers the full range of Embedded Cloud products and requirements. We offer all components from embedded computers in use on the factory floor to cloud servers running in IT data centres. Why is this important? There is often a lack of communication between corporate divisions. Oftentimes potential users are confronted with conflicting priorities in IT and OT, with both lacking a clear understanding of their respective counterpart. In such a team, every party naturally focuses on their field while the other remains unfamiliar. Having a vendor and partner who can fully grasp these difficult circumstances and considers both sides and their views can help break the barriers and become a guarantee for success in establishing a sustainable digital production strategy.

Kontron already offers all essential Embedded Cloud components. Some users, however, need an additional fully integrable, scalable, and connectable on-premise solution for their Industry 4.0 projects – the Embedded Server. For practical purposes, this means that the computing and storage capacity of cloud servers and the robustness of industrial servers will have to be combined. Industrial-ready Embedded Servers are still in the prototype phase at the moment but will be available in the near future.

The graphic shows how IT and OT play together in a Smart Factory environment. It also gives an idea of the complexity of a fully digitalized production process as laid out in Industry 4.0 concepts. All data collected by different devices during the production process are first brought together, then processed and analyzed on-premise. The Embedded Cloud forms the foundation for the Smart Factory and creates an interface where all important information from the production process comes together and is processed for further consideration. Real-time data processing and the comprehensive protection of all data stemming from the connected factory are an important requirement for success in a digitalized industrial environment. The Embedded Cloud is one, if not the most important milestone for the establishment of the Industry 4.0 and IIoT concept for good. ■

Product News

■ Neousys: machine vision platform with integrated LED lighting controller

Neousys Technology launched Nuvis-5306RT series featuring Intel 6th Gen Core i7/i5 processor paired with Intel Q170 Platform Controller Hub. It is the world's first fully featured machine vision controller in a compact footprint that integrates exceptional computing power, built-in camera interfaces and real-time vision-specific I/O controls.

News ID 5208

■ DATA MODUL: 27 and 32-inch LCD displays with UHD for industry

DATA MODUL already presented the first 27" TFT industrial display with UHD resolution from AUO, in line with the increasing demand for professional LCD displays with ever increasing resolution, at electronica 2016. Now the first 32" UHD LCD display is available for sampling with immediate effect. With a color spectrum of 95% NTSC, both 8 bit + Hi FRC* panels are ultra-true color and are thus ideally suited to medical applications, among others.

News ID 5198

■ Vecow: workstation-grade Embedded systems with NVIDIA GEFORCE GTX 1050 graphics engine

Powered by workstation-grade Intel Xeon/Core i7 processor (Kaby Lake/Skylake) running with dual-channel DDR4 2133MHz ECC memory and independent NVIDIA GeForce GTX 1050 Ti/GTX 1050 graphics engine supporting innovative NVIDIA Pasca architecture, Vecow's ECS GTX1050 series system delivers up to 28% system performance.

News ID 5218

■ ADL: 6th generation Intel Core Industrial 3.5 inch SBC

ADL Embedded Solutions announced their latest high-performance industrial 3.5" Intel Core single board computers. Based on 6th generation Intel Core Skylake processors and Intel's Q170 chipset, the ADLQ170HDS provides a robust set of features with breakthrough performance-per-watt. ADLQ170HDS features include 32 GB DDR4 DRAM, TPM 2.0, 4x SATA 6Gb/s, 4x USB 3.0, 4x PCIe X1, and much more.

News ID 5203

■ ADLINK: CompactPCI blade with 6th generation Intel Core processor

ADLINK Technology introduce the cPCI-6630 6U CompactPCI blade with the 6th generation Intel Core i7 processor in a 6U form factor on the embedded market. ADLINK's latest addition to its value line of processor blades also features support for legacy IO, including VGA, PMC, CompactFlash, USB 2.0 and PS/2 keyboard/mouse; and support for QNX 6.5/6.6 and Linux legacy OSes for easy integration.

News ID 5197

■ Axiomtek: fanless compact Embedded system ideal for extended temperature

Axiomtek announce the CAPA318, a fanless 3.5-inch embedded motherboard, featuring Intel Pentium processor N4200 or Celeron processor N3350 with low power consumption. The CAPA318 can be ideally applied to extended temperature environment from -20 to +70°C. It was designed to support one 204-pin DDR3L-1867 SO-DIMM with a memory capacity up to 8 GB. Furthermore, the compact-size embedded board with an emphasis on expandability offers two full-size PCI Express Mini Card slots.

News ID 5213

■ DATA MODUL certified in accordance with ISO 13485

DATA MODUL (DMO) works continually on the expansion of its service portfolio and from now on offers medical technology customers substantial added value in the development and production of professional control units for medical applications. With the ISO 13485:2012, the internationally recognized standard for quality management systems for medical product manufacturers, and the related adjustments that have been carried out – especially of the value-adding processes – to the regulatory requirements of medical technology, DATA MODUL now fulfills all normative conditions for medical product systems right through the product life cycle.

News ID 5212

IoT and Industry 4.0 front-ends based on an Open Standard I/O-Bus

By Andreas Foltinek, IMACS

This article introduces emBRICK, an open, modular-plug-in I/O-hardware for direct sensor/actor adoption for professional control and measuring applications. Hardware and software development can run in parallel, saving cost and time and substantially accelerating time to market.

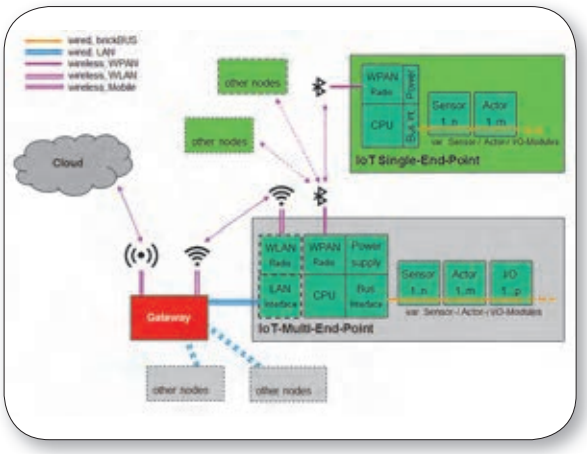


Figure 1. Standardization, the prior challenge of IoT

■ Some main driving factors against the background of Internet of Things and Industry 4.0 innovations nowadays are, in addition to connectivity, the continuing miniaturization and higher integration of mechanical, electromechanical and electronic components. This leads to increasing functionality at smaller scale devices, but growing complexity down to sensor and actuator level of control systems. The related I/O infrastructure is radically changed by that. The software and hardware complexity within the functionality chain of control devices from the CPU to I/O components down to sensor/actuator level becomes more and more application- and vendor-specific.

Product maintenance, lifecycle management and/or functional replacement at I/O infrastructure level can become a challenge in terms of cost, compatibility and long-time availability of products. Approaches that might improve this situation are open source solutions emerging potentially into standards. Standards are a perfect means for interoperability between products offered by different vendors. Open source solutions on the other hand allow vendor-independent access to technology, know-how and resources by community driven innovations. As displayed in figure 1, a typical IoT infrastructure in an industrial environment may consist of end points integrated and connected to the cloud via manifold interfaces and communication channels. End point functionality may vary from simple switches to complex, multi-point infrastructures integrating power I/Os, power amplifiers and intelligent sensor-actor combinations.

The biggest challenges to move IoT and Industry 4.0 visions into real products in this environment are missing or partly implemented standards. Standards are the key ingredient to support a seamless integration of technologies, solutions, and products from sensor level to the cloud. Industry-wide standardization efforts are mainly driven by the big worldwide industrial and political players via standardization bodies. Within the IoT and Industry 4.0 context, they focus on themes like communication infrastructure, safety and security norms or on more sector-oriented approaches like AUTOSAR for the automotive industry or OPC-UA for industrial M2M communication.

On the sensor-actor and I/O level there are mainly existing company proprietary solutions, hence standards are missing and more complex to establish. The reason for that is legacy and grown infrastructures serving a huge variety of diverse requirements. Because of that there are currently no major activities seen by the standardization bodies to address this issue. Some consequences of missing standards to interface CPUs and sensor/actors are: isolated solutions, proprietary technologies within the nodes, incompatible sensor/actor-CPU interfaces amongst vendors, missing interchangeability options of vendor independent solutions, longevity of technology and higher risk of investment. Thus, from project design to serial production including lifecycle management, the overall project and product cost will stay high. Additionally, the project management will stay more complex and more inefficient.

To address this limitation, IMACS GmbH decided in 2013 to introduce an open, modular-plug-in I/O-hardware for direct sensor/actor adoption for professional control and measuring applications. This new combination of technology, products, and I/O infrastructure is known as emBRICK and offered under an open source license model. To ensure a high market acceptance the emBRICK technology basis is available free of cost under an open source license. That covers for example circuit diagrams, protocol stack software and reference design information. It is a single master, multiple slave I/O-system. The different modules, called bricks, can be easily plugged together to get the required amount of I/Os. They are initiated by a generic boot process without any manual configuration. This combines in a perfect way the cost-ef-

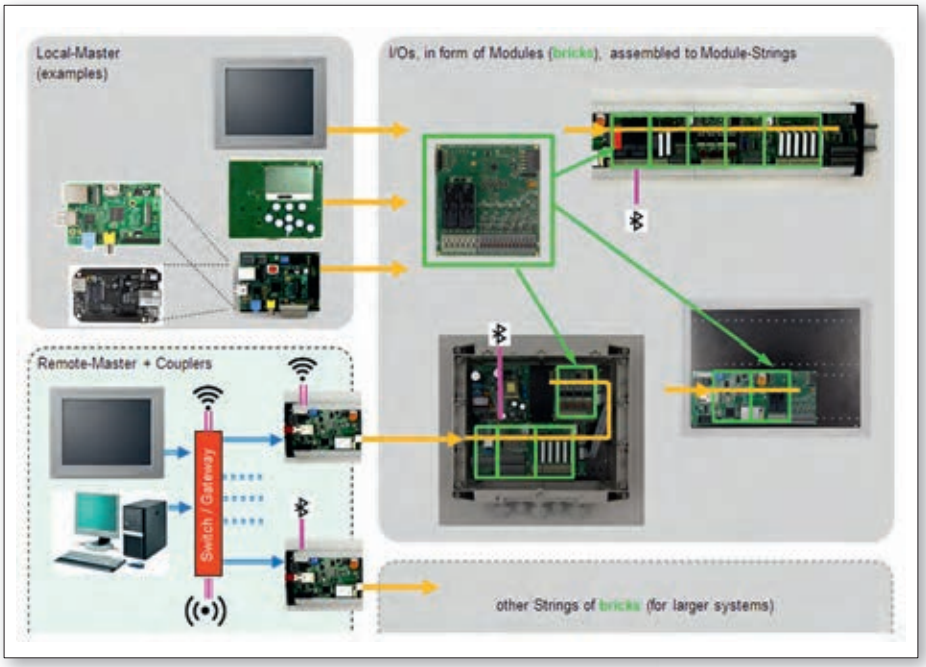


Figure 2. emBRICK components and topology examples

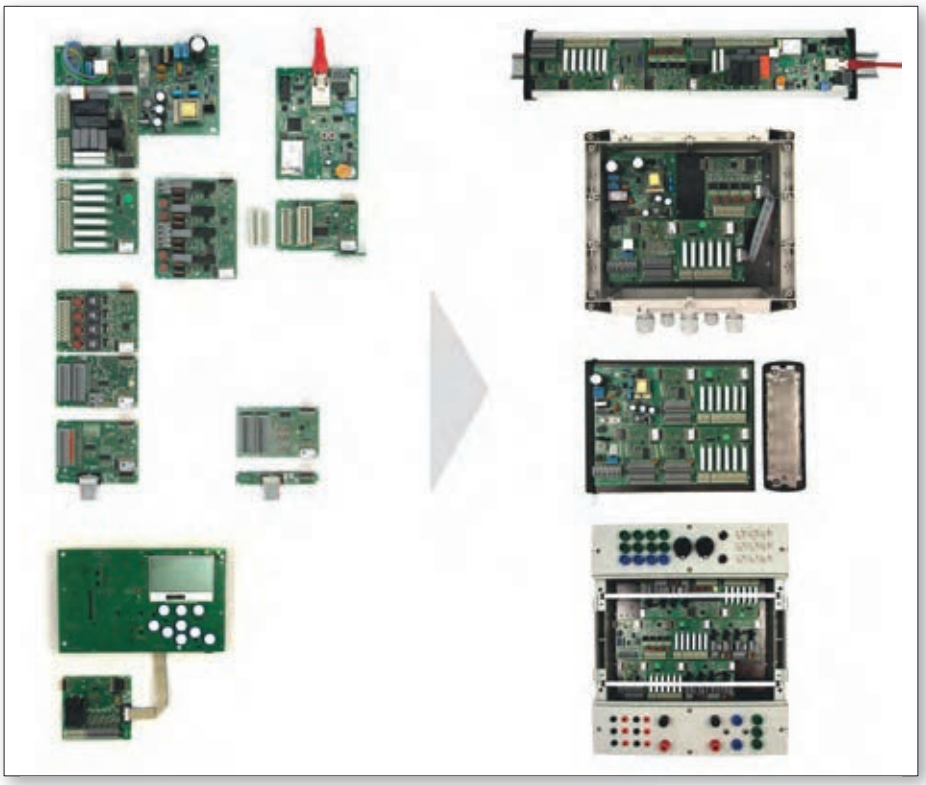


Figure 3. Examples of available emBRICK components

ficient and tailored characteristics of a dedicated embedded system with the readiness to use and flexibility of a PLC system. The communication between control masters and the I/O slaves is performed by a specifically designed, open source, robust and simple serial bus system the brickBUS. This I/O concept combines the advantages of a PLC with embedded design approaches, e.g. flexibility and minimal development cost with favourably priced, more compact and sector-specific I/O hardware. brickBUS allows single master multiple slave system designs just by stacking from 1 to more than 1000 I/O modules to realize powerful and flexible embedded PLC solutions. The extremely simple low cost connection is based on SPI or GPIO and can be driven by literally every µController, industry PC or other embedded control device. It supports slave power management, auto configuration, is industrial grade and as mentioned already available under a modified open source BSD license. The bus protocol code and documentation is freely available by example targets. It is targeted for custom applications and can be applied by the use of off-the-shelf low cost controllers. Furthermore, by available couplers the architecture is open for LAN, WLAN, CAN, Fieldbus or serial line communication. For a fast jump start, as of today there are more than 50 I/O bricks for different industries (e.g. building and industrial automation), various autarkic host systems and coupling boards, starter kits, enclosures and mounting kits available.

The programming environment is based on standards like C, C++, IEC61131 conform programming (e.g. CODESYS) or UML modelling tools (e.g. eTrice, SiSy, radCASE, Enterprice Architect). Supported are various RTOSs, Windows, Linux or middleware solutions like GAMMA. The initial intention of the emBRICK technology was to enable control systems by: connecting small existing I/O modules, the bricks, in a plug and play fashion (auto detection and configuration), linking to any available master controller independent of CPU architecture, allowing flexible scalability and application-specific topologies, and addressing a wide range of performance and energy requirements. Furthermore it should have an I/O bus that is flexible and combines various I/O capabilities without complex and time-consuming engineering and development cycles, interconnects to any existing industrial and IoT communication infrastructure, shows PLC functionality out of the box with the flexibility of an embedded system, saves project cost and development time with no need to re-invent the wheel, offers the concept in an open source license model to allow community-driven technology development and vendor independence, achieves project cost reductions and guarantees investment protection.

Combining these characteristics, embedded control systems and/or PLCs based on the emBRICK technology can be a suitable means to reach out from sensor/actuator levels into IoT and Industry 4.0 infrastructures. The ready-to-use construction kit works right out of the box and can be extended or upgraded without any configuration or reinstallation processes. It is freely programmable, robust and reliable, highly performant and is therefore especially suitable for applications in industrial and building automation, mechanical and plant engineering industries, control and measurement markets or process technology. emBRICK is a perfect fit for prototyping projects which can rapidly move into production. Hard and software development can run in parallel, saving cost and time and substantially accelerating time to market. ■

Why device management in the IoT matters and how to achieve it

By Keith Shea, Wind River

This article outlines the business case for efficient device management and introduces a solution for managing edge devices remotely, reliably, and cost-effectively.

For most enterprises, the compelling case for the Internet of Things (IoT) is the ability to access the valuable data being generated by hundreds or even thousands of field devices. That can happen only if the devices delivering that data and the gateways that direct data to enterprise systems are continually performing as expected. Device manufacturers and IoT system developers need to think upfront about how to manage those devices.

Data may be the hero of the IoT story, but the real workhorses are devices at the edge of the IoT system - the things in the Internet of Things. They're out in the field either generating and transmitting data to a centralized platform or performing automated tasks that generate data. A mundane job, perhaps, yet the overall performance of a system often hinges on the health of field devices. If a device, sensor, embedded agent, or gateway begins faltering, the consequences can be dire.

The challenge of maintaining devices may sound basic compared with aggregating and analyzing data, but it's essential to a successful IoT strategy. At a minimum, device manufacturers and system operators need a way to monitor the health of devices in the field to prevent system disruption and downtime. More importantly, they need to have an action plan: how to remedy those problems that will eventually occur. With IoT, change is constant. Business priorities will shift as companies gain insights about their operations from the data. So system operators need an efficient, scalable way to provide updates across a large fleet of devices. Security, too, is a major concern. If vulnerability is discovered in device software, patches must be deployed quickly - before intruders can exploit the gaps.

Device manufacturers and system developers need to plan for these contingencies at the design stage. With potentially thousands of field devices in play, it's not feasible or cost-effective to rely on truck rolls for fixes and updates. Instead, what's needed is a way to perform these tasks remotely, at scale, and over the Internet. But IoT data collection typically runs just one-way—from device to cloud. Even when operators detect device anomalies, they typically don't have the tools to push commands back to the device and fix the issue. So the initial design of an IoT system must consider the entire operating lifecycle, from deployment to decommissioning. Several distinct but interrelated issues must be addressed.

Once devices are deployed and connected, operators need a way to activate and provision them efficiently. Today, that often means physically going from device to device and loading applications or performing upgrades manually. IoT system operators need to be able to configure, provision, and manage field devices remotely. Device security is critical to an IoT system. Hackers often target endpoint devices as a means of gaining entry. And security breaches at the device level can have severe consequences: financial losses, damage to credibility, and even endangerment of human life. But securing devices is challenging since they're vulnerable to both physical tampering and network-borne threats. System operators need the right tools to monitor remote device performance and check for security vulnerabilities. They also need to be able to send instructions to those devices to correct a problem or change a function. This requires full two-way communication, where responses to devices can be completely automated.

Historically, information technology and operational technology systems have been kept separate. But IoT systems need to be integrated, with a centralized place to aggregate, analyze, and store data. While the devices in enterprise applications can perform for years, the software running on them will require regular updates and upgrades: from bug fixes to security patches to overall software improvements. And once an upgrade or a new application is ready, operators need to be able to deploy it quickly and cost-effectively to

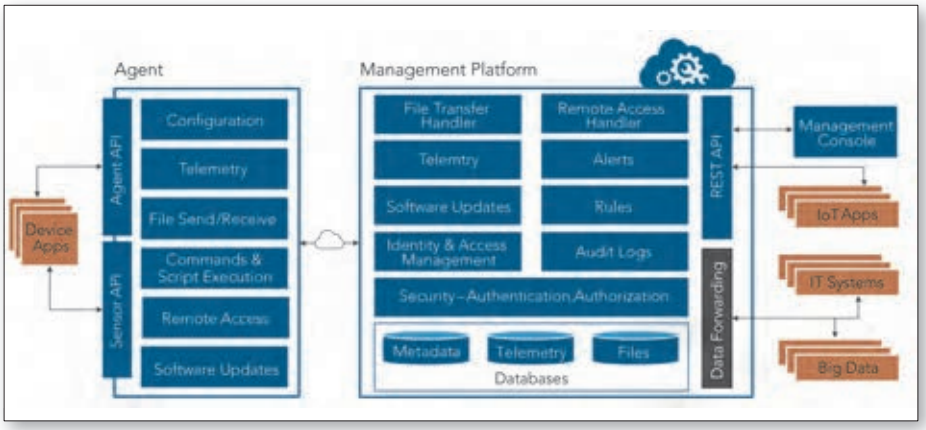


Figure 1. Block image of the Wind River Helix Device Cloud

many devices at once. Developers must plan for end-of-device life at the design stage so operators can easily and remotely remove a device from service.

The challenge facing every IoT system developer and operator is how to gain consistently reliable and secure remote control over devices typically far away and connected via the public Internet. Device management should be part of an IoT strategy from inception. But trying to build device management and two-way communication capabilities into a system from scratch can take time, devour resources, increase costs, and delay deployment.

A more practical solution is to leverage technology designed specifically for IoT device deployment and management. Wind River Helix Device Cloud is the ready-built platform that makes it possible. The solution also provides RESTful APIs, enabling IT and OT professionals to quickly build vertical-specific IoT solutions and integrate disparate enterprise IT systems. With Device Cloud, industrial companies can easily build device management capabilities into their infrastructures and greatly reduce the complexities of rolling out large-scale device deployments. Device Cloud gives customers the following abilities.

Deploy: connect devices to the cloud. Devices can be provisioned via a startup.bin file, authenticated via certificate exchange, and configured via network settings in the OS.

Monitor: record device-related information. Data is collected on device health (CPU, memory, etc), operations (pressure, speed, etc), connection status, and device alerts, for example.

Service: diagnose and repair devices remotely. Device application log files and historical trend data are analyzed, a tunnel is established to allow secure, remote device access, and repair procedures (change settings, push updates, etc) are conducted, when necessary.

Manage: track device properties and changes. The agent reports device properties and other "inventory" information that may be useful for understanding what is running in the field.

Update: deliver content and software updates. Updates can be made to files, application software, the agent, and even the OS kernel.

Decommission: remove devices from the system. Devices are stopped but agent files remain (deactivate), device is returned to factory default state, or devices may be deleted from the cloud, and all device data is erased (decommission).

Device Cloud automatically collects and integrates data from disparate devices, machines, and systems, enabling operators to track device status, share data, and proactively determine when updates are needed. Using an embedded software agent, device properties and operating data can be transmitted securely to the cloud. Operators can easily view device information through a web-based management console, perform diagnostics, and take prompt corrective action. The cloud-based platform is also designed to integrate with enterprise systems that utilize or analyze data from IoT networks. Device Cloud data and event forwarding ensures that device health issues will signal other systems of potential problems, allowing them to respond accordingly and prevent ingestion of potentially bad data.

Recent security breaches with connected field devices have brought the urgent imperative to protect connected systems to the forefront of the IoT conversation. Security is imperative for IoT applications, for the protection of the machines they control, and for the people who depend on their reliable performance. Further, an industrial company's success hinges on securing their connected devices and their data. Effective security requires an end-to-end strategy that spans the entire application lifecycle.

Security adds a additional layer of complexity. Without proper planning, building in security functionality can slow down development, drive up costs and, in some cases, impair the performance of a deployed application. With Device Cloud, users can build IoT applications on a platform using pre-configured, integrated software components in which many security issues have already been addressed. This takes the onus off developers to identify, source, and patch together different security technologies as development progresses, resulting in a much more efficient development process, much less system complexity, and a reduced risk of security gaps due to misconfiguration. Device Cloud includes a wide range of pre-configured features that enable developers to implement security measures across the device lifecycle at the design stage, including: secure boot, device software update mechanism, SPM, application whitelisting, network, data, and device encryption, embedded credentials and certificates, Trusted Platform Modules, access permission, software isolation, and integrity measurement. By providing pre-integrated security components, Device Cloud helps developers mitigate the risk of misconfiguration and implement security without delaying development or compromising system performance.

With IoT adoption becoming widespread, a growing number of enterprises are unlocking the valuable data generated by their everyday operations: gaining business insights, optimizing operations, improving profitability, and uncovering new business opportunities. But IoT can only be effective if connected devices are actively monitored and managed. Fortunately, technology exists that makes it easier to build that capability into IoT devices and systems. Utilizing Device Cloud, device manufacturers and IoT system developers can accelerate device deployment and close a critical gap in IoT operations, ensuring that the devices enterprises depend on for crucial business data are secure, responsive, and performing at the highest possible level. ■

Product News

■ **Portwell: flexible wireless sensor nodes for IoT applications**

Portwell announces a series of wireless sensor nodes, DS-1 and DS-1B, supporting Arduino IDE and a wide variety of options for sensors and wireless connectivity. The DS-1 series integrates numerous sensors with the electronic and mechanical characteristics, dramatically decreasing circuit and mechanical complexity.

News ID 5223

COM Express Type 6 as basement for visual solutions

This article is contributed by Data Modul

This article highlights how the providers of visual solutions can focus on the control technology of display solutions and embedded computing design in order to realize state of the art customer-specific solutions.

Figure 1. Baseboard and COM Express module developed especially for visual solutions

■ Customer-specific embedded computing solutions are realized on the basis of individual customer requirements, and based on the necessary market-specific specifications. Providers of visual solutions like Data Modul focus specifically on the control technology of display solutions and embedded computing design. An embedded development team conceptualizes board designs based on the pre-series releases of the appropriate processor platforms, and thereby enables the initiation of development projects for systems upon the market launch of a new platform. This speeds up the development and production times for innovative products. In this context, the FMEA (Failure Mode and Effects Analysis) that accompanies the development is just one building-block in ensuring that the aspirations surrounding the highest possible design quality of new embedded products are guaranteed.

Whether ARM or x86 based, embedded CPU boards are available in different form-factors and performance classes. In addition to a preconfigured kit consisting of the embedded board, display, adapted cable set and specific OS image, providers of visual solutions also develop and implement customer-specific baseboards and operating units with integrated CPU boards, displays and touch screens. Starting from serial reference designs on the COM Express (Computer-On-Modules) form-factor, specific designs are developed on a modular basis. The validated COM modules are also used as a so-called building block for customer-specific single-board computers. This offers the customer validated core components, reduced levels of development work and a lower qualification period. With LCD controller boards and display control kits, the embedded solutions are then complete. What needs to be considered when developing a module, and what does the performance-related offering for components in embedded computing and modular embedded PC solutions look like at present?

A sustainable reference platform, including for customer-specific SBC designs, is the COM Express standard as defined by the PICMG. In this standard, which is by far the most widespread worldwide, various pin-outs are defined. In addition to the current type 6 pin-out, the type 7 pin-out is to be approved soon. In this context, video outputs are completely dispensed with and it is therefore particularly suitable for headless server systems.

As before, COM Express Type 6 remains a perfect solution for systems with display and touch. The modules are available with low power SOCs (such as Intel Atom Class) through to high performance CPUs (such as Intel i Core Class). The dimensions, mounting holes and pin assignment (pin-out type) of the connections with the carrier board, with their typical, serial PC interfaces, such as PCI Express, USB, audio, graphics and Ethernet are specified. The specification of the pin assignment also guarantees the interchange ability of COM Express modules. If the system developer keeps 100% to the defined standard, an upgrade with new, next-generation COM Express computer-on-modules is possible at any time. Since the launch of the Intel Core platform Kaby Lake, which, like the predecessor platform Broadwell and

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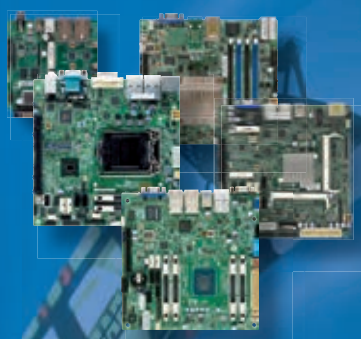
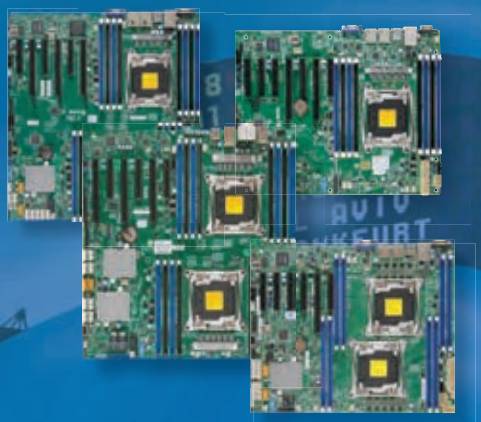


Small Form Factor
A1SQN, A1SAi, X10SLV,
X10SDV-F, X10SBA



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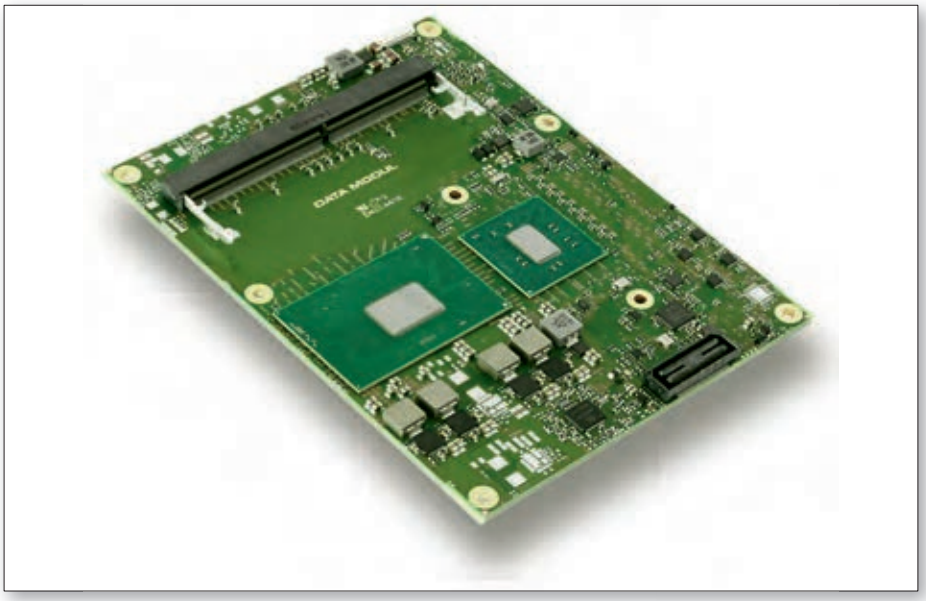

Figure 2. COM Express module Kaby Lake eDM_Comb_KL6

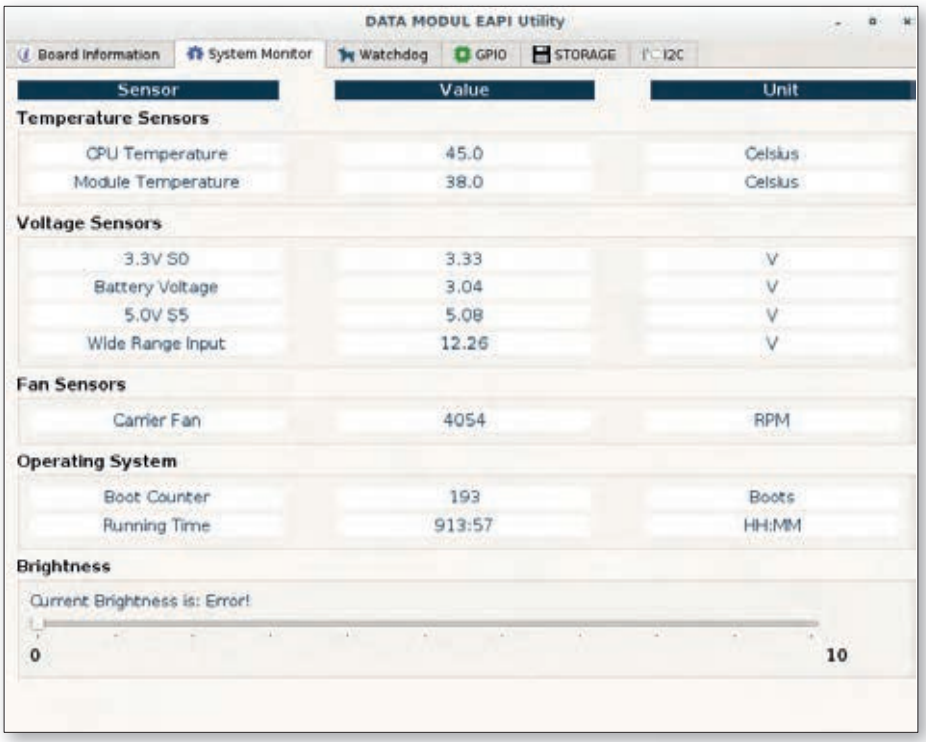

Figure 3. Data Modul EAPI utility with system monitor data

Skylake, is based on a 14-nm process, it has been possible to provide industrial customers with samples of the corresponding COM Express Basic Type 6 modules. Kaby Lake offers higher clock rates and adjustments to the media features. In this context, Data Modul has developed the eDM-COMB-KL6 module, which is suitable for industrial products with high-performance requirements and a low level of power consumption. It is equipped with the latest 14nm Quad Core Intel Core i7 and Xeon processors, and offers 8 MB L2 cache at a TDP of 25-45 watts. For the middle level, it is equipped with Quad Core Intel Core i5 and dual core Intel Core i3, which offer 6MB and/or 3MB L2 cache at a TDP of 25-45 watts. Intel Smart Sound Technology will bring significant improvements in the area of voice control. The integrated graphics are offered by the latest Intel Gen 9 HD Graphics Generation GT2. DirectX 12, OpenGL 4.3, OpenCL 2.0, hardware MPEG-2 decoding, WMV9 (VC-1), H.264 (AVC) and Ultra HD Blu-ray are all supported, ensuring the high-quality playback of HD video material. The new HDCP 2.2 support with HDMI 1.4 also facilitates the processing of 4k content (Premium UHD). Up to three independent displays with a resolution of 4k@60Hz can be simultaneously controlled with different contents. In addition to 3 x DP ++/HDMI 1.4 / DVI, 1 x VGA (optional) also dual-channel 24-bit LVDS is available as display interface. As BOM option eDP (Embedded DisplayPort) can be equipped instead of LVDS. This allows the new, high-resolution 4k TFTs with eDP input to be used without the need to redesign the customer plug & play baseboard.

The new Intel memories are supported by Kaby Lake and operate as current system accelerators for computers with seventh-generation Intel Core i processors. According to Intel, Intel Optane offers an exceptional performance, short boot times and rapid-response browsing for large-volume bulk memory systems without compromising any memory capacity. To be able to offer 100% specification-compliant modules, the board controller is a possible solution. Data Modul implements all the solutions with its proprietary Data Modul Embedded Controller DMEC, which is based on a FPGA (Field Programmable Gate Array). It also offers additional embedded features that make a module into a real embedded module. These very small but essential details distinguish standard PCs from embedded PCs. In addition to this, in this instance, an essential basis is created to develop systems for industrial use.

As the connection to the main processor via LPC-BUS is set to be phased out for future processor generations, Data Modul has prepared the eSPI-BUS for the FPGA at an early stage. This means that future modules can also be supplied in compliance with the specifications. Two UARTs with up to 115,200 bauds have been designed, the I/O addresses and IRQs of which can be set in BIOS setup. UART1 can also optionally be supplemented with RTS/CTS signals via the available GPIOs. An I²C controller enables up to three I²C buses to be operated via the integrated multiplexer. The Automatic Bus Clear feature prevents possible interruptions to the bus. In addition to this, Multi-Master and FastMode + are supported. In this respect, up to 400 kHz can be set in the normal mode, and up to 800 kHz in the FastMode+.

In the standard mode, the integrated Window Watchdog supports three stages. The initialization of the watchdog is only permitted within a specific timeframe, and covers scenarios in which the software hangs up in a loop within the watchdog trigger routine. An NMI, reset or even an IRQ can be triggered (if activated in the BIOS setup). The support of Auto Reload makes it possible to use the watchdog as an event ticker. A register block which aims to prevent the deactivation of the watchdog and a change of its configuration in

Figure 4. Baseboard reference design for medical applications

safety-critical applications is an equally essential component and fully configurable via the BIOS setup.

In addition to the boot counter, the integrated runtime logger (RTM) includes the possibility of tracking the time in which the module has run at too high temperature. The thermal trip point can be set in order to determine the temperature which is to be rated as excessively high. With the IO-Multiplexer, it is also possible to realize programmed customer-specific features. In this respect, an SPI Bus, a PWM signal generator and a CAN Controller can now be integrated without any additional hardware costs.

On the software side, the standard functions which are also defined in COM Express are accessible via so-called EAPI calls. For this purpose, for Windows and Linux, EAPI drivers are available for the complete portfolio and all future upgrades. This means that many important functions and information can be incorporated into the application software for the subsequent system. The various possibilities can be evaluated on the standard modules using the provided Data Module EAPI utility. This utility features a clearly-designed graphic user interface that enables the testing and use of all the aforementioned API functions. The following functions are supported: board information, real-time information, I2C bus, watchdog, GPIO, and user storage area. The key features are described in more detail below. It is possible to retrieve all the most important board information, for example.

The system monitor displays the continuously updated information from the hardware monitor, the running time meter, and the brightness of the backlight. With the values of the temperature sensor, the fan sensor and the backlight, it is also possible to control the embedded PC accordingly. To program the watchdog described in detail already, it is also possible to use the straightforwardly-configured EAPI utility.

For systems with high performance requirements that are equipped with the long-lifespan (up to 2031) Skylake module eDM-COMB-SL6, for example, it is necessary for up to 47 watts to be dissipated on a small area. In this context, the optimum cooling solutions require a connection with additional fastenings to ensure the specified contact pressure. This requires both a special engineering solution and specific know-how. Recently developed standard solutions can now be integrated in a casing via thermos-simulation on an optimum basis.

As the market leader for industrial displays in Europe, Data Modul offers a database with EDID 1.4 files for more than 500 different TFT displays. These data sets have been tested and certified for the scaler cards (eMotion series) which have been supplied for many years. These files are also used on a one-by-one basis in all embedded CPU solutions. This means that it is no longer necessary to think about the different timings and settings for the desired TFT. The developer simply orders the panel file for the required display and saves it on the module and they are all done! The portfolio of leading display manufacturers includes diagonals from 1.2 " to 100". Industrial customers and their developers have a variety of configuration options, and with the many differing features and components, the optimal system solution can only arise on the basis of interdisciplinary collaboration. ■

Embedded singleboard computers with extended functionalities

By Flemming Christensen, PC/104 Consortium

This article reviews singleboard computers (SBCs) in various formfactors that can have their functionality expanded by installing extension modules. It is particularly concerned with the possibility of expanding the system with new I/O interfaces or brand new functions that were not initially integrated into SBCs.

Figure 1. EBX form-factor with PCIe/104 Expansion connector and integrated MiniPCIe for I/O expansion

■ The term singleboard computer implies a module, including components, built on a single printed circuit board, with all the necessary functionality to be called a computer. For this purpose, it should be capable of executing application programs and possess the means of human-machine interface. The larger the printed circuit board is, the more components it can have installed, making the single board computer more functional. In terms of speed, functionality and number of interfaces available, modern SBCs are far more advanced than the entire computer systems manufactured 25 years ago. Well, that's the way it should be, and Moore's Law is still relevant. It is possible that in another 25 years SBCs will be able to replace some server racks of current data centers. But what stays common and what is inherited? A confident answer can be given to this question – the system design principle remains unchanged. Despite significant technical differences, the foundation for building any computing system or module is based on a common principle – interconnection via common interfaces or extension buses, various components and units, each fulfilling its own function.

At a given point of computing technology development, certain interfaces and extension buses got widespread use. In the age of mainframes, almost all peripheral devices had their own control consoles, often connected with a CPU just using an 8-bit interface bus, physically represented by a set of arm-thick multimeter cables. Introduction of minicomputers enabled to increase the width of a common bus and reduce its length, since all these electronic components fitted in a single rack or several racks alongside. Then, there were bus and modular systems where a common bus was implemented as a passive backplane and CPU and peripheral modules were standardized in terms of their size and the ways they were combined into a unified formfactor. The increase in the hardware components integration level enabled IBM to use a CPU board as a motherboard simultaneously.

With the introduction of microprocessors, the technology of interfaces and extension buses usually followed the innovations of microprocessor manufacturers. First, those were 8-, 16-, 32-, and even 64-bit parallel buses, such as ISA and PCI buses, then parallel buses were replaced with high-speed serial buses, and connection topology started to be changed from multi-user bus to the star type topology, with functional nodes connected with each other by separate interface lines using the point-to-point principle. Such a trend had an impact not only on general purpose interfaces, where PCI Express currently prevails, but also on special-purpose interfaces for peripheral devices (SATA, USB etc).

Despite the fact that modern motherboards can operate in the standalone mode, they are not called singleboard computers since their application supposes using extension boards anyway. In addition, since the term singleboard computer is generally used in the embedded systems market, they are also usually subject to additional requirements, appropriate for this type of market, such as the possibility to boot the operating system from an integrated flashdrive, a watchdog timer, the storage of setup parameters in the non-volatile ROM etc.

Notwithstanding that initial functionality of SBCs is often enough for a complete system development, engineers equip them with additional extension possibilities. Why? The answer is simple: the product developed by one company is subsequently used by another. Of course, if an SBC is developed for a particular custom system, the developer can plan all the required functionalities on a single board in advance. However, those vendors who offer their solutions on the open market have no idea about the systems where their equipment will be used. They cannot cover all possible requirements within a single board, neither because of the board size limitations, nor pricewise: not everyone is ready to pay

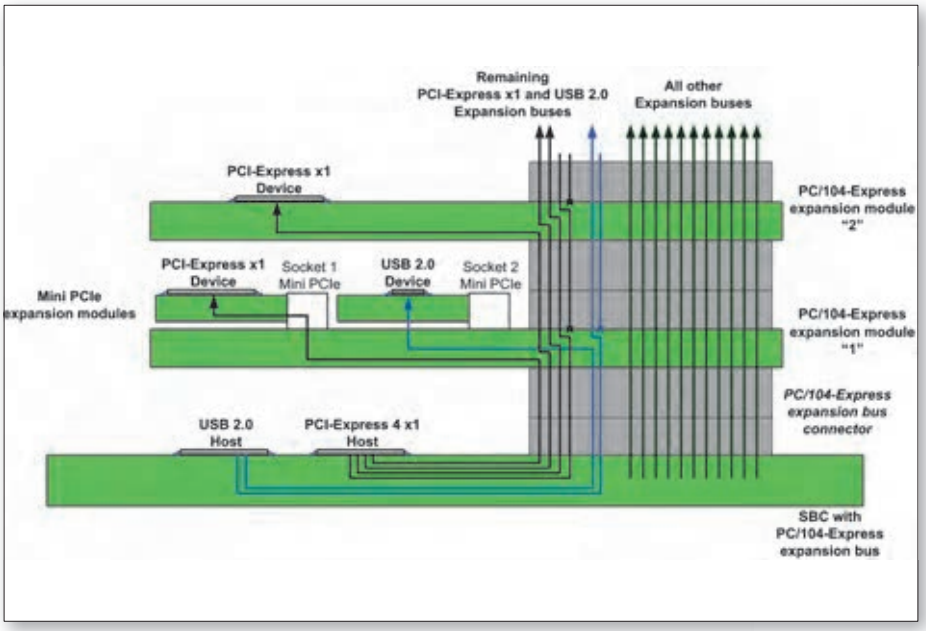

Figure 2. The PCI Express Bus stack up/downwards and up to 10x boards is possible, without any buffers and running Gen 3 speed of 8GHz

for functions they may not need. This is why vendors do their best to offer a well-balanced set of functions and interfaces aimed at a specific application area and also limited extension possibilities. It should be also noted that the interface possibilities of the chipsets used often go beyond the scope of routing these interfaces through general-purpose connectors, due to the board size limitations, and in such cases it can be necessary to ensure a standard method of using these extra interfaces by means of so-named bareboards.

There are three common methods of extending functionalities of singleboard computers, by riser cards, by extension slots and modules, and by means of stack systems.

1) Riser cards.If current is supplied to any modular CPU board (e.g. Compact PCI), such a board becomes in fact a singleboard computer. In this case it can be extended by relevant peripheral modules connected via a riser card for one or two additional slots. However this approach failed to get widespread use mainly for pricing reasons. There is a more common and cost-effective way of using an edge connector with the singleboard computer, which implements the bus of the personal computer in order to ensure the extension possibility of its functionalities with the help of standard extension boards for personal computers (figure 1). An advantage of such an approach is a vast selection of inexpensive extension boards for personal computers, using simple and price-oriented riser cards that use standard connectors for PCI or PCIe. On the other hand, using such systems is limited by some applications due to their insufficient resistance to mechanical impacts and the narrow operating temperature range of extension boards focused on the consumer market. In addition, the use of the regular extension boards means that the single board computer size itself is rather large (usually no less than MiniITX).

2) Mezzanine extension modules. Various extension modules find a rather wide application with singleboard computers. They can roughly be divided into proprietary and standard solutions. When it comes to the proprietary solutions, the connector type, list of interfaces brought out to this connector and its specific pin assignment are determined by the vendor and are usually used in the vendor's own developments only. A good example here is the MIO interface by Advantech. There is a relatively large number of standards varieties for extension modules. Those like PMC, XMC, FMC etc.are focused on the Eurocard-based CompactPCI, VME, VPX and other standards, as well as on the basic size of the 3U/4HP board. This results in a too-low-profile solution which virtually fails to find a proper use for the single board computers. In practice, compact extension modules of the following types are more widely used: Mini PCI, Mini PCI-e, mSATA, M2 etc. Mini PCI-e format is well-known due to its compactness, support of up-to-date interfaces and cost-efficient connector, a technology that has been tested with RAM extension modules over a long period of time. By using Mini PCI-e modules (figure 2), some manufacturers provide their SBCs with more than one extension slot. On the other hand, the compact size of such modules prohibits them from implementing complex functions, or placing large-size or high current consump-

Figure 3. Industry form-factor 3.5" meets PCIe/104 expansion concept

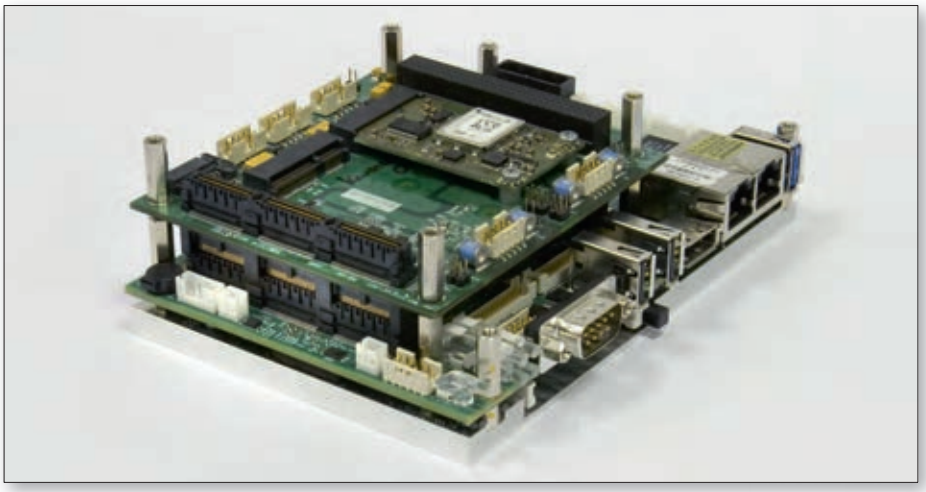

Figure 4. PCIe/104 Expansion boards can hold either 2 or 4 MiniPCIe cards for quick expansion of I/O

tion components on them. The interfaces to the outside world of these modules are usually pin header type small connectors, this is why integration of modules into the system usually requires special-purpose cable assemblies.

3) System stack extension.For the purpose of stack extension, the SBC has a vertical connector to which the extension module is connected, that in return is equipped with a similar connector on its upper part in such a way that enables to place another extension module on the top of it and so on. This means that unlike the option already described, the stack extension technology makes it possible to place several extension modules above the extension connector, rather than placing a single module. This issue will be given particular consideration. The best known of the stack extension systems is PC/104 standard, more precisely the group of standards of the PC/104 Consortium (from this point onward, PC/104 will mean any module of 3.6"x3.8" implemented in accordance with the requirements of any of the PC/104, PC/104-plus or PCIe/104 standards). Evolution of the standard from ISA bus to PCI Express over almost 25 years of its history, as well as its technical features, have been described many times.

The group of PC/104 standards describes three form factors of single board computers: PC/104, EBX, EPIC, and one PC/104 form factor of extension modules. The difference is in the size of the printed circuit board and placement areas of interface connectors. Common is a stack connector for connecting the extension modules to the CPU board. It's an interesting fact that PC/104 was initially offered by Ampro exactly as a form factor of extension modules enabled to extend EBX CPU modules' functionality. However in this case they were called MiniModule (PC/104 format prototype) and LittleBoard (EBX format prototype). Later there were PC/104 format CPU modules, which made it possible to build fully-fledged embedded computing systems in the form of a stack of the boards having the same formfactor.

Similarly to standard motherboards, the single board computers in EPIC and EBX formats, as well as in other common formats (3,5", MiniITXetc), usually have a certain set of interface connectors standard for the PC industry. Normally they are located on one of the board edges, while the PC/104 format due to its limited size enables to use only edge connectors for interface cables. This feature often determines the design of PC104-based systems. A stack of PC/104 modules where both CPU and extension modules are implemented in 3.6"x3.8" format is mainly used for installation into a protected enclosure with cable output of interfaces to special-purpose connectors, located on the external side of this enclosure. That is how one may build compact-size computing systems for the IP65+ protection class. Purely stack system configuration is usually created for a particular solution or even for a particular customer, however in this case you can choose the modules with the required functionality among the modules of various manufacturers that have already been put into production, and thus save some valuable time for system development and testing.

Singleboard computers of the larger size, such as 3.5", EBX, EPIC, MiniITXetc, can also be manufactured with output of interfaces to connectors of the pin header type for their allocation in sealed protected enclosures. Despite this fact they are increasingly used (e.g. in so called Box PCs) where there is no need for a high level of protection and where a far less expensive and mass standard enclosure can be used, and the availability of PC-industry standard interface connectors does not require additional cables manufacturing.

In both cases, the choice of PC/104 as a way to extend the possibilities of singleboard computers has proved itself to be quite a successful solution. The board simultaneously enables the use of other extenders, e.g. by way of the Mini PCI-e slot. The PC/104 modules size (neither too small nor too big) is sufficient for rather complicated functionality implementation, and the possibility to use several extension modules having only one extension connector on the singleboard computer provides the system integrator with additional flexibility during the system development process.

It should also be noted that compared to single-storey mezzanine extension modules, the recent version of the PCIe/104 standard, supporting the modern PCI Express interface, generally enables a more efficient use of the available set of interfaces. E.g. Mini PCI-e or 2 standards make it possible to bring several interfaces (PCI-e, USB etc) to extension connectors at once, however in this case if the extension module uses only one of these interfaces, the rest of the free interfaces remain unused and wasted. The PCIe/104 specification solves this issue by a so-named line shift-

ing mechanism, when the extension module picks up only those interfaces which it will use and, at the same time, ensures the availability of all other interfaces for extension modules that are next to it. Figure 3 shows an example where the first extension module uses one 1xPCIe line, and the second module uses one USB port. In this case, the third possible module can use all the rest of the unoccupied interfaces.

Development and marketing activities of the PC/104 standards arecarried out by the similarly-named consortium founded in 1992. As for the developers of systems based on stack modules with extension bus, PC/104 provides them a wide selection of standard components from various manufacturers, which are compatible with each other. In fact, the advantage of using any standard extension method for single board computers means adding potential for modernization, time saving due to the use of standard functional modules proved in operation, and ensuring interchangeability of modules of various manufacturers.

Many of us remember that some years ago, PC/104 was widely used as a traditional way of single board computers functionality extension. However, PC/104 has currently given up its position in this field, for a wide range of reasons. First, ISA and PCI parallel buses are getting out of date, while the new PCIe/104 standard that supports modern interfaces turned out to be not particularly fit for extending functionalities of singleboard computers. Let's try to analyze.

The PCIe/104 specification determines one-bank or three-bank Q2 Samtec connector for extension. The one-bank version is a cost-efficient and compact-size extension using 4 lines of 1xPCI Express. However the number of such modules on the market is currently very limited, all the extension modules have the limited load-carrying capacities of power buses 3.3 and 5 volts. The highly desired function to output additional existing interfaces to the next levels using the bare board is not supported, extensions modules able to directly operate with other interfaces (e.g. SATA drives) are not supported either, capacities for high-performance singleboard computers and extension modules (e.g. graphics or fast-operating optics) are insufficient. According to the standard, there are two options of three-bank connector, named Type1 and Type2. Both types have a powerful 12 volt power supply bus and are distinguished by a set of interfaces in the second and third banks (their interfaces in the first bank are the same as with the single-bank option). Type1 additionally has 16 PCI Express lines and Type 2 has 2x ports 4xPCI Express, LPC bus, 2 x USB and 2x SATA ports.

For low-performance SBCs that do not have graphics 16xPCIe bus, the natural choice would be Type2. But as for the high-performance singleboard computers, there is a problem. Usually the vendor has no idea about the application where his device will be used, but he will have to choose between Type1 and Type2. Simultaneous use of the both Type1 and Type2 is not supposed. Thus having chosen for example Type1, the vendor will ensure the possibility of extension by for example using high-speed graphics modules, however in this case it would be impossible to use the modules designed for Type2 interfaces, and vice versa. Developing two different versions of the same singleboard computer individually for Type1 and Type2 would be too expensive. And neither version would be able to ensure simultaneous use of the Type1 and Type2 extension modules.

If we consider Type2, which is more appropriate for traditional embedded systems, it has its own disadvantages in terms of the well-balanced set of interfaces. There is no Ethernet interface at all, which means that it would be impossible to use the Ethernet switch extension module. There are only two USB ports, which is of course insufficient for state-of-the-art systems. At this point it makes sense to note the initiative called StackPC, which makes it possible to mainly solve the above issues.

StackPCdetermines only one option of the main extension connector, which is fully compatible with PCIe/104 – one bank, considerably compatible with PCIe/104 Type2. In this case, there will be 2x Gigabit Ethernet ports and 6x USB ports instead of two. In addition, there will also be an SPI interface, which can be used as the interface with low-speed modules of digital and/or analog I/O, as well as two general-purpose serial ports, which cand be directly used by extension modules with RS-232, RS-485 etc. The main StackPC connector contains a well-balanced set of interfaces meeting the requirements for a general number of embedded systems. For high-performance interfaces, there is an optional FPE connector (Fat Pipe Extension) where such interfaces as 16xPCIe, Display Port, 6xUSB 3.0 are placed. Both main and optional connectors can be used at the same time, which makes it possible for the system developer to jointly use low-speed and high-speed extension modules, andto have one single-board computer version for any type of application. Figure 4 demonstrates an example of a singleboard computer corresponding to the StackPC specification. Technologies do not stand still, and we believe that soon we will see new interfaces, technologies and methods of extending single board computer functionalities. ■

The All Programmable SoC enters the maker arena

By Aaron Behmanand Adam Taylor, Xilinx

The maker sphere provides both a popular hobby for many and an inspiration for young people to follow careers in science, technology, engineering and math subjects. Many of the projects within this sphere contain an embedded processor, commonly a member of the Arduino or Raspberry PI families, to provide the intelligence required.

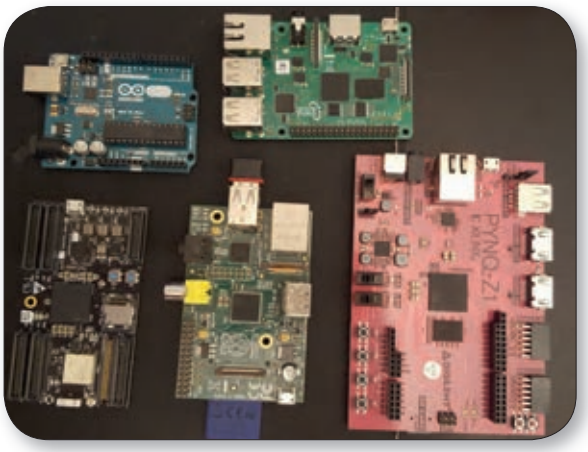

Figure 1. Maker development boards: left to right Arduino, ZynqBerry, Pynq, Raspberry and Snickerdoodle.

Both Arduino and Raspberry PI are supported by a development environment which provides a range of software libraries, modules and examples. These aid the developer to quickly and easily interface with a range of peripherals from cameras to accelerometers and motors. It is this ease of use which reinforces the popularity of these processors within the maker sphere.

Until recently makers have considered All Programmable SoCs to be outside the sphere and something for the more specialist engineer. This, however, is no longer the case with the introduction of Zynq-based boards like the ZynqBerry, Pynq and Snickerdoodle and software-based development techniques. These boards are fitted with devices from the Xilinx All Programmable Zynq-7000SoC family which combines dual ARM Cortex-A9 processors with programmable logic from the All Programmable Artix-7 FPGA range. This provides the ability to accelerate the functions within the programmable logic fabric to significantly increase system performance. Traditional development however has segmented the design of the programmable logic from the software development, requiring specialist development experience to implement programmable logic design. But this is no longer the case. When these boards are coupled with the latest development environments which allow the application to be defined entirely in software, they become very interesting for this sphere. Especially, as these development environments provide the ability to exploit the programmable logic without the need for the user to be a FPGA specialist, providing the best of both worlds.

There are two development environments which can be used to create applications for these Zynq-based development boards. The first of these is the SDSoC development environment which is eclipse based. This environment allows the development of the application in C or C++, and then to seamlessly move functions from running on the ARM Cortex-A9 processors for acceleration in the programmable logic. The SDSoC environment uses High Level Synthesis (HLS) to move the selected C function in to the programmable logic. Once the HLS has completed connectivity, framework is used to integrate the HLS module with the software application. Apart from the performance boost provided by the acceleration of the function now in the programmable logic, the process is transparent to the user. Moving functions between the processors and the programmable logic is extremely simple and controlled within SDSoC using the project overview. When it comes to operating systems, SDSoC supports Linux which is commonly used within the maker sphere along with a real-time operating system (FreeRTOS) and a bare metal approach.

The second approach is provided by Pynq, which provides a development framework based upon Python and Juypter notebooks. Both are executed on a Linux distribution running on the processors while the programmable logic has a defined overlay which provides connections to the peripherals provided on the Pynq. Within the Linux distribution to support the peripherals and hardware overlay, there is a defined Pynq package which allows us to directly interface with the peripherals using Python. As Pynq provides two PMOD interfaces this package delivers significant support for a range of PMOD such as ADC, DAC to ease the integration with the Python application. Within Pynq the programmable logic is loaded with one of many overlays to offer hardware acceleration, there are several open source overlays in addition to the provided basic overlay. The users can programme Pynq by connecting to the Juypter notebook server via a web browser. Once connected to this notebook, they can develop and document their Python applications to run on Pynq. The ability to use Python and directly interface to the PMODs using Python provides for a very powerful development platform.

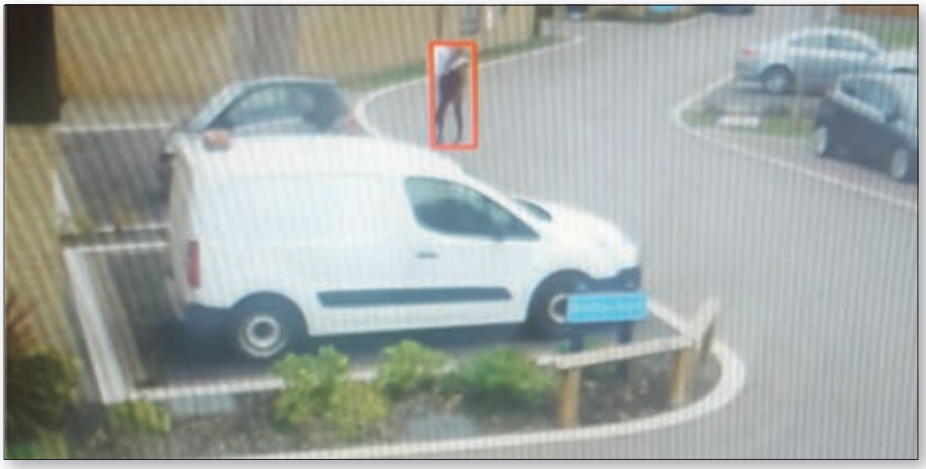

Figure 2. Result of the image tracking application

Both development methodologies provide the ability to use open source embedded vision frameworks like OpenCV to perform embedded vision applications. These applications can use web cameras when the Linux distribution supports the USB Video Class, or specific cameras like the Raspberry PI camera supported by the ZynqBerry. OpenCV allows them to develop in either C/C++ or Python, using this framework they can quickly and easily implement complex image processing algorithms using the acceleration of Zynq programmable logic to provide significantly higher performance. These applications can process images and detect objects or faces and more, using this framework.

When it comes to implementing a simple object detection algorithm they can run Linux, Python and OpenCV on Zynq-based platforms. Let us examine what is involved with implementing a simple object tracking system using OpenCV and a web camera. The algorithm they will implement is:

1) Capture the first frame from the web cam. This first frame serves as the reference background frame. They will detect any changes that occur in the scene from this first frame.

2) Convert the colour space from RGB to grey scale. This is a commonly used image-segmentation technique used to create binary images. Image segmentation covers several techniques that divide an image into multiple segments often called super pixels. Segmentation allows for easier analysis of the segment contents. In their application, they can use thresholding to segment the background from the foreground. This will produce a binary image.

3) Perform a Gaussian blur on the image. The performance of many image-processing applications that detect objects or edges can be negatively affected by noise present within the grabbed frame. Blurring the image prior to further processing reduces noise within the frame and this technique is often used for image processing, particularly for edge-detection algorithms (for example, the Laplacian of the Gaussian edge-detection algorithm). The result of this operation becomes the reference image against which to detect a change.

4) Repeat steps 1 to 3 again, that is capture another image from the web cam, convert the colour space to grey scale and perform a Gaussian blur on the image.

5) Calculate the absolute difference between the reference frame and the most recent captured image.

6) Perform a thresholding operation on the absolute difference to create the binary image.

7) Perform a morphological operation to dilate the image to enlarge any differences.

8) Find the contours remaining in the binary image and ignore any contours with too small an area.

9) Draw a box around each of the contours detected and display the original captured image over the HDMI output.

Developers can run the resultant Python code either directly on ZynqBerry or within a Juypter note book on Pynq. What they see is an image like the one below which identifies the changes from the reference image with boxes highlighting the differences. This example demonstrates both the power and ease with which they can use Zynq to perform their embedded vision application, using familiar open source frameworks. The presented development environment demonstrates the ease with which developers can exploit the capability of several Zynq- based development boards. These development environments enable the user to create applications which execute on the processors within the processor but accelerate their designs using programmable logic. ■

Product News

■ Microchip: SAM R30 system-in-package for wirelessly connected designs

Microchip announces the SAM R30 System in Package (SiP), a single-chip RF microcontroller which incorporates an ultra-low power microcontroller with an 802.15.4 sub-GHz radio to provide multi-year battery life in a compact 5 mm package. The SAM R30 SiP delivers design flexibility and proven reliability all in a small package, making it ideally suited for connected home, smart city and industrial applications.

News ID 5240

■ Würth: high quality inductive components

At PCIM Europe, Würth Elektronik eiSos will exhibit intelligent drive technology, renewable energy and energy management. Highlights include the WE-HCF SMD high current inductor in 2815 package, WE-DPC HV magnetically shielded, coupled SMD power chokes, extremely efficient wireless power coils with up to 200 W transferable power and the shielded LAN transformer WE-LAN AQ.

News ID 5239

■ ams launches tunable-white lighting smart system sensor

ams announced the AS7225 tunable-white lighting smart system sensor, further broadening the solution set for sensor-integrated tunable-white lighting solutions. With the addition of the AS7225, OEM lighting manufacturers can access ams' closed-loop CCT tuning and daylight compensation, while retaining the existing host microprocessor architecture in their smart lighting design. The result is higher precision, more flexible LED binning, and lower system costs for tunable white lighting systems.

News ID 5189

■ ADI: buffered 18-bit octal ADC with picoamp inputs shrinks solution size

Analog Devices announces the LTC2358-18, an 18-bit, 8-channel simultaneous sampling successive approximation register ADC featuring integrated picoamp input buffers. The LTC2358-18 brings substantial space and cost savings by eliminating front end signal conditioning circuitry normally required to drive unbuffered switched-capacitor ADC inputs.

News ID 5216

Embedded processor technology for vision-based space programs

This article is contributed by Unibap and AMD

Designing electronic systems for space applications is a huge challenge for designers. But this article shows that even modern standard processors can be deployed in this kind of application and significantly simplify the task.

Figure 1. Unibap uses the AMD G-Series as the intelligent computing core for its space applications. The CPU provides high computing power, high reliability and extremely high radiation resistance.

■ The selection process for technology intended for space programs is constrained and dominated by the requirement to operate in such harsh environments. The demands associated with acceleration, shock and vibration, the ability to withstand large variations in air pressure and heat, and a tolerance to radiation often point towards solutions developed specifically for such extremes. But it isn't always necessary; a recent example has put a standard processor from the AMD Embedded G-Series family into orbit, empowering a vision-based system performing analytical tasks using deep learning technology. With such impressive credentials, the same technology is clearly applicable to any Earth-bound application.

The continuous improvement of vision systems has led to outward looking programs like the Space Situational Awareness (SSA) Program, and satellite-based earthward-looking missions such as Earth Observation; both rely heavily on real-time vision data from satellites to monitor the space around us and our own fragile atmosphere. The SSA has the unique challenge of identifying hazardous objects that could threaten equipment and infrastructure both in orbit and on the ground. This includes monitoring the Sun and solar winds and their effects on the magnetosphere, ionosphere and thermosphere of the Earth, which can affect space-borne and ground-based infrastructure, endangering human life or health. It is also responsible for observing near-earth objects such as asteroids and comets, as well as active and inactive satellites that could potentially impact the Earth.

The challenge here is the huge amount of bandwidth needed to transfer data in the highest resolution, from satellites in orbit to the radar observation stations on the ground that are used to analyze the data. To illustrate this, current high-end vision systems used in orbiting satellites feature CCD and CMOS sensors producing colour images comprising 25 mega-pixels at video rates; an uncompressed image represents 75 Mbyte of data (30 fps is 18 Gbps). With up to 30 images taken every second, it would require a bandwidth of 18 Gbit/s to transmit. But the bandwidth of a link between a nanosatellite and an observation station on the ground is currently around 50 Mbps; a huge shortfall. Additionally, in the case of applications in deeper space, latency becomes a major problem if they need to be controlled from earth. The solution here is to use autonomous intelligence, allowing satellites and vehicles to self-navigate and perform in-site cloud computing with data mining, extraction and indexing. Engineers are now developing technologies that can pre-process and analyze the massive amounts of raw data gathered at source alongside the vision sensors. This reduces the transmissions down to only the most relevant data, instead of huge streams of raw image data.

This creates a need for smart cameras and sensors generally able to support parallel processing of data on a massive scale, coupled with the execution of deep learning algorithms. Massively parallel processing is needed to accelerate the processing of data from any kind of sensor, from high resolution CMOS sensors with 25 mega-pixels of data, to radar data streams. With conventional CPUs, high performance can be maintained when complex instructions are limited to operating on a single piece of data at a time. But image processing requires parallel processing, a single instruction operating on multiple data at the same time. Multicore processor architectures, such as General Purpose Graphical Processing Units, are used to accelerate processing throughput while at the same time lowering overall system power. Massively parallel processing is also an enabling technology for deep learning algorithms in machine intelligence.

Deep learning is required for high levels of abstractions, which allow decisions to be made more naturally than a simple 'If, Then, Else' format. Deep learning enables a com-

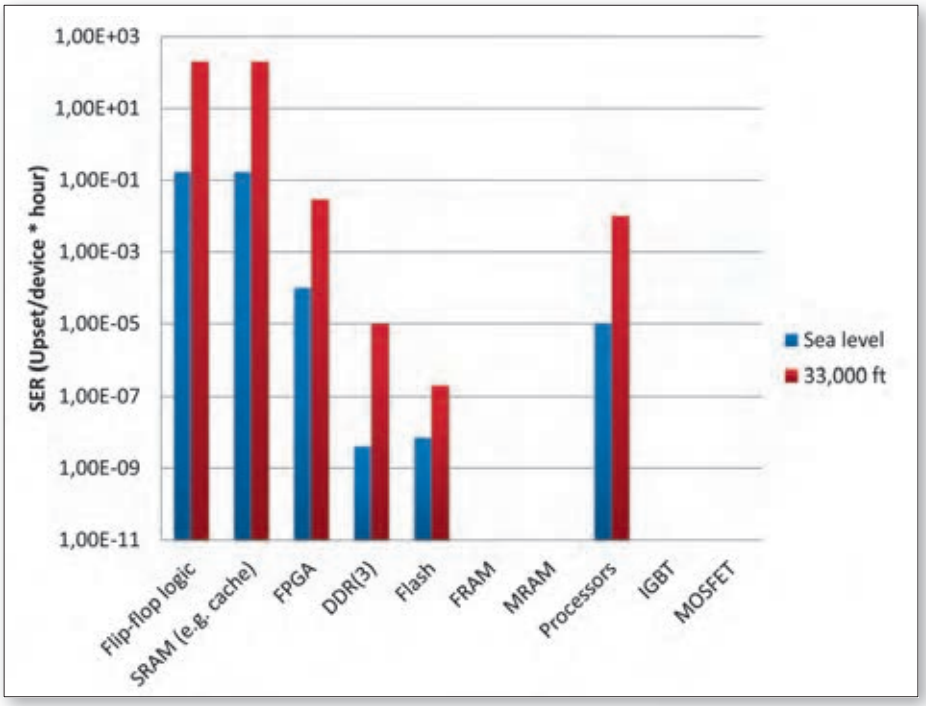

*Figure 2. Susceptibility of common electronics to the background neutron radiation cross-section Single Event Ratio (Upset/device*hour). In order to compare different technologies, the SER values have been normalized to a size of 1 GByte for each relevant technology.*

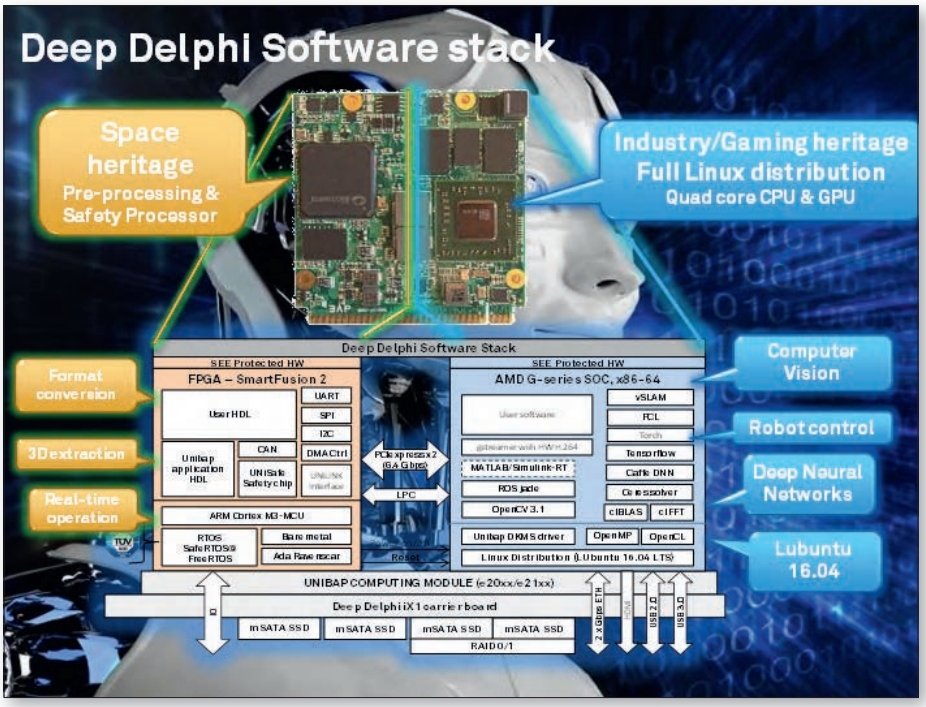

Figure 3. Already in use: the Unibap Deep Delphi software stack is already computing directly in space.

puter to better identify objects based on experience; drawing from hundreds or thousands of correct examples. Using deep learning, a machine can better differentiate between images of objects and the objects themselves. For example, using deep learning on a Mars mission, the equipment was able to understand that a rock with all the elements of a face could not, in fact be a face. This human-like intelligence makes machines better able to make decisions, at least with respect to specific and well defined tasks. To address these demands, Unibap has developed a platform which complies with the highest NASA Technology Readiness Level, TRL-9. Employing machine learning algorithms for processing, indexing and storing data, it is built on the Linux Lightweight Ubuntu 16.04 LTS operating system, which has been optimized for applications such as vision processing, robot control, point cloud handling, deep neural networks and scientific operations. It supports high-level interpreted languages including Octave and Python 3, design and simulation frameworks such as MATLAB and Simulink, and relational databases including MySQL and SQLite. A fault-tolerant system with ECC memory error correction offers 6TByte of local storage over native SATA V3 ports and can be expanded with RAID controllers on PCIe with RAID 1/5/10, and 100 GFlops of heterogeneous computing performance. The platform comprises a multicore CPU and GPU with advanced FPGA technology, making it ideal for running deep learning algorithms. The platform has already been deployed in a space information processing solution. The software provided for the platform is based on the Unibap Deep Delphi software stack, a cross-platform solution able to support x86, ARM Cortex-M3 and FPGA state-machines.

Satellites with this kind of capability can enable many different mission scenarios, for instance accurate situational awareness for rapid distribution of information to war fighters; not fast enough to provide real-time data to fighter planes, but able to deliver accurate information about the bombardment of buildings, or strategic information about the movement of ballistic missiles with a resolution of seconds. This makes it instrumental in a combat situation, allowing operatives to follow the movement of resources in real-time. The same technology is used in bio-informatics, in-situ bio-analytics and bio-photonic processing. It is also being applied in autonomous vehicle operations on Mars, as well as interplanetary exploration. On Earth, there are a growing number of application areas for such technology, ranging from autonomous vehicles to remote video surveillance and even human-assist applications.

As the central processing core, Unibap selected technology from AMD, with good reason. First and foremost, it offers a combination of CPU and GPU processing which has already made it a preferred choice for many vision-based applications. AMD is also leading the field of heterogeneous system architectures that can maximize the function of each system block in order to offer more performance at lower power. These attributes are the perfect foundation for vision-based space programs, where the available power is limited. Unibap started evaluating the AMD Embedded G-Series processors for space-based customer programs and discovered that the AMD technology excelled in another significant area, resistance to radiation. This is becoming an important attribute not only

for space programs but for any Earth-based application that must preserve the highest level of data integrity. This includes any application where human life could be at risk due to a Single Event Upset (SEU), caused by radiation originating in space, leading to lost data. Guaranteed data integrity is one of the most important preconditions for meeting the highest reliability and safety standards. Every single calculation and autonomous decision depends on reliable data, so crucial is it that data stored in RAM is protected against corruption to prevent corruption of the instructions carried out by the CPU/GPU. However, SEUs can still lead to errors. They are caused by background neutron radiation, which is always present and occurs when high energy particles from the Sun and deep space hit the upper atmosphere of the Earth, generating a flood of secondary isotropic neutrons with enough energy to reach ground and sea level.

The Single Event probability at sea level is between 10-8 and 10-2 upsets per device-hour for commonly used electronics. This means that within every 100 hours, one Single Event could potentially lead to data corruption, jeopardizing functionality. It is here that AMD G-Series SoC(s) excel, by providing the highest level of radiation resistance (and therefore safety). Tests performed by NASA Goddard Space Flight Center have shown that the AMD G-Series SoC(s) can tolerate a total ionizing radiation dose of 17 Mrad(Si). This surpasses, by far, the current maximum permissible values; 400 rad in a week is lethal to humans. In standard space programs, components are usually required to withstand 300 krad. Even a space mission to Jupiter would only require a resistance of 1 Mrad. In addition, AMD supports advanced error correction memory (ECC RAM), a feature which is used to detect and correct errors caused by Single Events. Although a Jupiter mission would require the software code to be small enough to run from the internal L2 cache, as there are no known DDR memories that can withstand the same massive radiation. ■

Product News

■ Infineon: high voltage MOSFETs address power classes from 100 W to 15 kW

Infineon Technologies extends its existing portfolio of CoolMOS technologies with the 600 V CoolMOS P7 and 600 V CoolMOS C7 Gold (G7) series. The product families are designed to operate at 600 V breakdown voltage and deliver improved superjunction MOSFET performance. They achieve unmatched power density in the respective target applications.

News ID 5183

■ Sensirion: metal-oxide gas sensor opens up new possibilities for environmental monitoring

Sensirion introduces the SGP long-term stable metal-oxide gas sensor. The SGP gas sensor is based on Sensirion's multi-pixel platform, which integrates four gas sensing elements into a very small 2.45 x 2.45 x 0.9 mm³ DFN package featuring a fully calibrated air quality output signal.

News ID 5188

■ TI: reinforced isolator with integrated power

Texas Instruments introduced a new single-chip reinforced isolator with integrated power that offers 80 percent higher efficiency than existing integrated devices. Compared to discrete solutions, the ISOW7841 integrates both isolated data and power, enabling a smaller bill of materials and reduced board space, as well as helping with easier and faster system certification.

News ID 5161

■ Microchip debuts updated mobile-optimized E-Commerce website

Microchip debuted its updated, feature-rich and mobile-optimized e-commerce platform for purchasing microcontrollers, mixed-signal, analog, Flash-IP solutions and more. microchipDIRECT, which sells Microchip parts directly to customers, has been updated with several new mobile-accessible features that are now available for the first time in the semiconductor industry.

News ID 5169

■ Rutronik: latest PIC MCU family and development board available

With the PIC16F15386 family, distributor Rutronik presents the most powerful launching point into the 8-bit PIC microcontroller portfolio from Microchip. In addition to Microchip's current Core Independent Peripherals (CIPs), this new family includes a high-accuracy 32MHz internal oscillator and memory features such as Memory Access Partition with bootloader-friendly write-protection to prevent accidental over-write. The PIC16F15386 family is suitable for a broad range of general purpose and low-power applications.

News ID 5170

■ Mouser distributes Coilcraft products globally

Mouser Electronics has expanded the global distribution agreement with Coilcraft. In addition to Europe, Asia, South America and Central America, Mouser is now authorized to distribute Coilcraft's products throughout North America.

News ID 5138

■ Xilinx: partial reconfiguration enables dynamic field updates

Xilinx announced the 2017.1 release of the Vivado Design Suite HLx Editions, with broad availability of Partial Reconfiguration technology to enable dynamic field updates and increased systems integration in a broad range of applications such as wired & wireless networking, test & measurement, aerospace & defense, automotive, and data centers.

News ID 5226

■ Renesas accelerates industrial networking application development with RZ/N MPUs

Renesas Electronics announced the new RZ/N Series of industrial networking communication microprocessors that simplifies network-based application development. The RZ/N Series is ideal for use in industrial network devices such as network switches, gateways, programmable logic controllers, operator terminals, and remote I/O units.

News ID 5097

■ Coilcraft: power inductor selection tool provides more performance data

Coilcraft has launched a new suite of Power Inductor Selection Tools that allows users to easily select the appropriate path for their particular search while also providing more application-specific performance data than previously available on any industry site. Entering the new tool, users are offered four paths depending on whether they need inductors for a known converter topology, a specific IC they want to use, an existing set of inductor specifications, or they simply want to compare inductors they have already chosen.

News ID 5180

■ Infineon: flyback controller and integrated power IC CoolSET family

Infineon Technologies introduces the fifth generation of the stand-alone quasi-resonant flyback controller and integrated power IC CoolSET family. The latest development in this family of devices offers improved efficiency, faster startup, and better overall performance under varying load conditions. The new ICs are especially designed for AC/DC switch mode power supplies in a great variety of applications such as aux power for home appliances, server, and industrial SMPS.

News ID 5210

Improving the automotive power distribution architecture

By Philippe Dupuy, NXP

In automobiles, a revolution has occurred in essentially all design aspects, from engine management to body control functions, to wheels, braking, safety and more. Only one aspect remains the same as a century ago: the power distribution architecture. This remaining vestige is about to undergo the same transition as the others - and join the revolution.

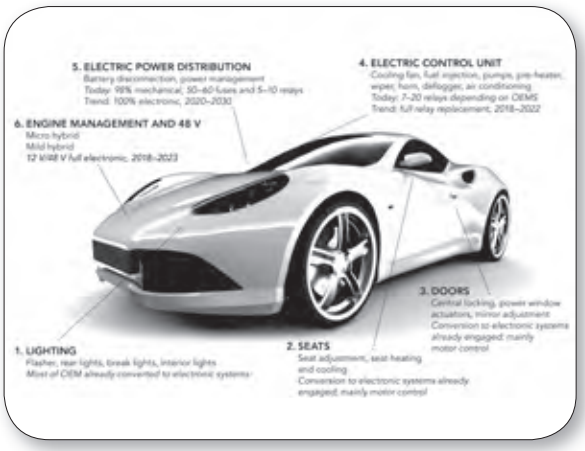

Figure 1. Relay replacement has occurred at different rates in various areas of the car.

■ The ongoing electrification of vehicles impacts all vehicle systems and provides an excellent reason for overhauling automotive power distribution architecture. Three major forces drive this push for electrification: the connected car model, new powertrains and regulations, and the globalization and consolidation of platforms. There are two aspects that will be considered in this analysis: relay replacement and fuse alternatives. Figure 1 shows the current status for automakers in six specific areas.

For lighting 1), relay replacement has already started to occur. The same is true for seating 2) and doors 3). However, for the electronic control unit 4), relays are still commonly used for cooling fans, fuel injectors, pumps and more, ranging from 7 to 20 units depending on the original equipment manufacturer (OEM). The trend in this area is full replacement with a solid-state alternative between 2018 and 2022. The big future for electrification will come from the junction box in electric power distribution 5) with revised power distribution architecture. From 50 to 60 (or even 100) fuses and from five to ten relays are required to distribute power from the battery to a module or group of loads. For example, a fuse + wire that goes to the body controller could control several different functions. Today, almost all manufacturers use relays and fuses in the junction box. The trend from 2020 to 2025 or even to 2030 will be to replace all the mechanical pieces in the car distribution box. The last box 6) is engine management. With 48V power increasing for stop-start systems and other mild hybrid applications, the relay can no longer satisfy the load switching requirements due to arcing on the 48V bus. This arcing subsequently creates other system issues. As a result, 48V applications dictate solid-state solutions.

For the connected car trend, the vehicle power network must connect to the external power source of a fixed structure. In addition to the power, connecting a 48V mild hybrid car to a fixed structure requires communication between the 48V port in the garage or external 48V source and the vehicle. Many new features will come with 48V capabilities, such as X-by-wire, that require high quality and a high level of safety. The trend being discussed is classifying the wiring harness as an ISO 26262 element for critical areas such as steer-by-wire and brake-by-wire. As a result, the wiring needs to be considered as a safety-critical aspect compliant with ISO 26262. While the ISO specification has been required for many automotive safety aspects for several years, its addition to the wiring harness is rather new. The added complexity from having both 12V and 48V power sources in vehicles creates design challenges as well as challenges in assembly, servicing and aftermarket to ensure compatibility and isolation between systems. While automotive technology will be even more advanced and ready for these applications than it has been in the past, the real driving force for power distribution architecture replacement will come from new functions of the connected car for which relays are not adequate. For example, the stop and start function being embraced by many manufacturers has an impact on some applications, such as windshield wipers. With the stop and start function, the mission profile for a wiper system dramatically increased in terms of the number of switching cycles, far beyond the capability of any common relay. As a result, the relay is no longer adequate to perform as expected over the lifetime of the vehicle. This same situation occurs for relays in other applications such as pumps and the HVAC system.

The cost savings behind wiring harness optimization and vehicle weight reduction drive the second argument for overhauling automotive power distribution architecture via electrification. For example, in the European Union (EU) communities, the cost per gram of over-limit CO2 emissions will increase in 2019 to 95 Euros for the first gram that exceeds the EU limit. Avoiding these costly penalties

	Dry contact relays EMR (electromagnetic relays)	Smart power SSR (solid state relays)
Power consumption	~ 2 W (Coil)	~ 50 mW (5 mA)
PCB space	~ 20 x 20 x 20 mm	~ 9 x 9 x 2 mm
Blocks reverse current	YES	YES
ON/OFF cycles	< 300 K	> 1M
Bounce-free switching	NO	YES
Magnetic Interference	YES	NO
Contact aging	YES	NO
Wetting current	YES	NO
Power dissipation	~ 1 W (Contact)	~ 1 W (Ron)
Leakage current	Small	Few µA
Prevent arcing	NO	YES
Direct drive from UC	NO	YES
PWM control	NO	Up to 1 kHz
Silent switching	NO	YES
Response time	< 10 ms	20 µs range
Protection & energy discharge	NA	YES
Normally closed contact	Possible	Two smart power SSRs needed

Table 1. Comparison between a mechanical relay and a solid-state relay

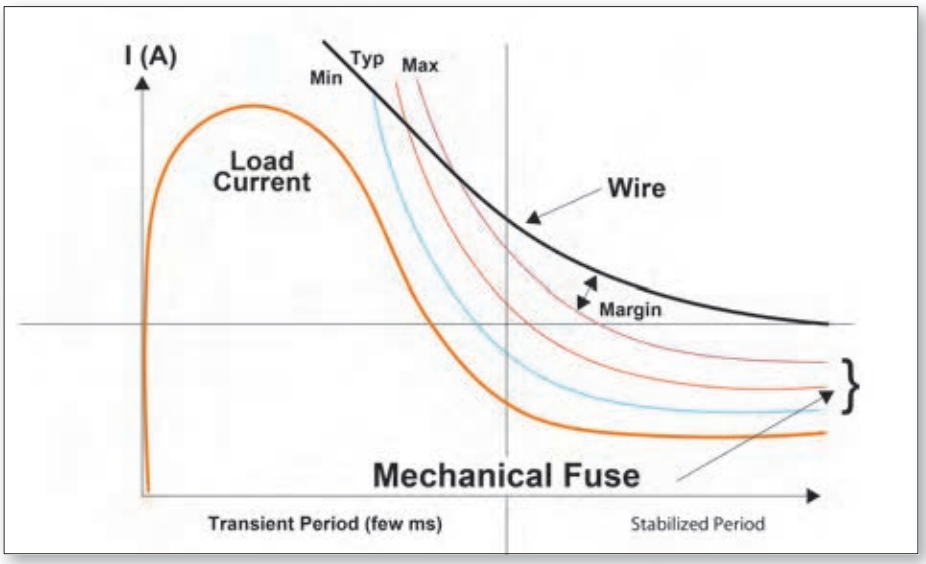

Figure 2. Inaccuracy is a major problem associated with mechanical fuses and a cause of over-specifying wire size.

should motivate OEMs to optimize and trim wiring harness weight, especially since the harness for a mid-line vehicle has an average weight of 30kg. The last trend is globalization. With mega-platform approaches, OEMs can minimize engineering time and the associated cost as well as reduce the overall time-to-market for new vehicles. A single platform provides commonality for a range of vehicles at a minimum of engineering effort and expense. For semiconductor suppliers, the wiring harness including power distribution must be as flexible as possible to be compatible with low- to high-end cars. The replacement of mechanical relays with semiconductor technology has been proposed for over 30 years and the capability to replace fuses has been possible for almost 20 years. However, significant reductions from existing alternatives are required to make the transition compelling enough to reject the status quo. Today, some OEMs still need to initiate the design activity required to make this transition. Solid-state relays have several differentiating features and benefits compared to mechanical versions. Table 1 shows a comparison of well-known characteristics. One of the more well-known problems of mechanical relays is contact bounce. Contact bounce or rebound can create dV/dt values up to 300 V/µs. Eliminating all the mechanical relays will allow the reduction of electromechanical interference (EMI) noise in the harness. One example of an incentive for replacing mechanical relays is a safety regulation that requires anti-pinch diagnostics/protection. For a mechanical relay, meeting this regulation requires many additional components that make the mechanical design much more expensive. These expensive elements add even more justification to increased system requirements. With 48V, mechanical relays will have severe challenges to be compliant. A modern high-end vehicle can easily have 100 fuses and four fuse boxes that need to be accessible for servicing and fuse replacement. The cost of this space and access in the passenger compartment is very expensive because it detracts from passenger comfort. Since a solid-state protected device (an electronic or eFuse) does not have to be replaced after a short circuit occurs, it can be placed in an area that is not easily accessible. This configuration simplifies vehicle design and provides additional passenger compartment space. In contrast to the mechanical fuse that is designed for a single value and is not programmable, an eFuse can be programmed for 10, 15, 20 or however many amps are required. This flexibility makes the electronic fuse fully compliant with mega-platform vehicle designs.

Mechanical fuses, especially the ones being manufactured today, have inaccurate minimum and maximum values that require the wiring to be oversized to have sufficient safety margin under all extremes. Common aftermarket replacement fuses play a significant role in meeting the oversizing requirement to avoid unsafe operating conditions and ensure that the fuse protects the wiring under all operating conditions. Figure 2 shows how the wire size must have greater safety margin because of the inaccuracy of mechanical fuses nowadays. Today, the main driving force for electronic replacement comes from carmakers and not the semiconductor industry. The OEMs know the value of the transition and are requesting the electrification of the car. While the silicon solution is more expensive, the carmakers calculations have led them to conclude that there will be cost savings at the system and vehicle levels.

Changes to the vehicle power distribution architecture depend upon the affordability of the solution to replace mechanical relays and fuses. As a result, this electrification is expected to go through several steps or phases. The first step could occur between 2018 and 2022. This phase will involve an electrification of the mechanical components but the architecture will remain the same. Electronic relays and electronic fuses will simply replace mechanical relays and fuses. Later, between 2020 and 2030, a transition to connected smart junction boxes and smart fuse boxes will occur and take full advantage of all the benefits that electrification can bring by revisiting the architecture to optimize the wire harness size, align it with the source capabilities and be ready for an autonomous car with a full safe and fault tolerant architecture. Some emerging concepts are under analysis at NXP to prepare for this future revolution. However, the electrification revolution cannot be solved by one company alone, and it needs cross-industry alignment. ■

SEGGER releases cryptographic library emCrypt

SEGGER announced immediate availability of its new emCrypt cryptographic algorithm library. emCrypt is a complete software library of cryptographic algorithms, written entirely in C, with high performance. It can easily be fine-tuned to favor smaller or faster code. Hardware acceleration for various popular MCU families such as STM32, Kinetis, EFM32 and LPC18S/43S is available.

News ID 5233

AdaCore: new Versions of GNAT Pro, CodePeer, QGen and SPARK Pro

AdaCore announced the release of GNAT Pro 17.1, CodePeer 17.1, QGen 17.1 and SPARK Pro 17.1. GNAT Pro includes a full-featured build toolset for Ada and C, Integrated Development Environments (the GNAT Programming Studio and the Eclipse-based GNATbench), a comprehensive suite of tools (a visual debugger, a coding standard checker, etc.), and an extensive set of libraries and bindings.

News ID 5121

Solid Sands: SuperTest to improve quality of C language in Silexica's SLX tool suite

Solid Sands announced that Silexica chose SuperTest to secure the quality of the C language in their tools. The task of compiling C code continues to be plagued with challenges and, for Silexica, this problem increases significantly as their tools instrument, analyze and transform source code with a goal to uncover parallelism.

News ID 5103

Conrad: high quality pan-European PCB service includes significant 24/7 support

Conrad Business Supplies has announced the immediate availability of a new pan-European PCB service in partnership with Eurocircuits further enhancing Conrad's focus on the R&D market. The service allows design engineers to quickly and easily order high quality PCBs from the same source as they use for components, giving an integrated solution for PCB projects.

News ID 5202

QA Systems announces Cantata version 7.2

QA Systems announces the upcoming release of the Cantata unit and integration testing tool for C and C++. The release focuses on making Cantata even easier to use and introduces a new Test Case Editor. This works in sync with the existing Test Case Manager to provide an intuitive and graphical way to edit test cases. Other enhancements have been made to the Cantata Eclipse® user interface including a dedicated Cantata menu and toolbar action buttons. Interactive tutorials have also been added to guide users in use of the tool.

News ID 5132

HCC Embedded adds HTTPS Client to TCP/IP networking stack

HCC Embedded has added HTTP Secure (HTTPS) Client to its high performance TCP/IP networking stack. As the Internet of Things continues to develop, the growth of embedded HTTP servers in devices that collect and exchange data runs the gamut from smart home, connected car, medical, and industrial control applications. HCC's HTTPS uses HCC's verifiable Transport Layer Security module to provide a highly flexible web-server solution for embedded systems that enables the creation of dynamic content within a highly secure environment.

News ID 5100

Vector Software: VectorCAST/Analytics offers real-time access to actionable code quality metrics

Vector Software announces new capabilities in VectorCAST/Analytics. VectorCAST/Analytics provides an intuitive, web-based dashboard of software code quality and testing completeness metrics, enabling users to immediately assess risk areas and prioritize test resources. Available with enterprise versions of VectorCAST/C++ unit testing and VectorCAST/QA code coverage and system testing tools, VectorCAST/Analytics is activated through a "quick launch" menu option that displays an analytics dashboard in a browser window.

News ID 5136

Rohde & Schwarz: three new entry-level test and measurement products

By introducing three entry-level test and measurement products with best in class performance, Rohde & Schwarz is fortifying its growing commitment to its value instruments range of products. The R&S RTB2000 is the first entry-level oscilloscope to offer a 10-bit vertical resolution as well as 10 Msample memory and a 10" touchscreen. The R&S FPC1000 entry-class spectrum analyzer features a flexible keycode upgrade concept, solid RF performance, the largest and highest resolution display in its class and integrated Wi-Fi for remote control.

News ID 5149

ETAS and Lynx to support next generation connected and autonomous vehicles

ETAS and Lynx Software Technologies unveiled a new collaboration. ETAS will provide and support the LynxSecure Separation Kernel for the automotive market. In addition, ETAS is supporting LynxSecure with a version of the RTA-BSW AUTOSAR solution and the ESCRYPT embedded security solution to run within the lightweight isolated virtual machine containers of LynxSecure.

News ID 5145

Green Hills: INTEGRITY RTOS supports Scalys SoM range

Green Hills Software's INTEGRITY real-time operating system now supports Scalys range of System-on-Modules. Users of Scalys SoMs can now rely on a trusted, safe RTOS that supports the highest levels of secure operation. Scalys offers cost effective standard and semi-custom embedded system solutions for market segments including industrial, medical, telecommunications and aerospace, which require safety-critical operation.

News ID 5148

LieberLieber: coordinator for EUROSTARS project

Following smaller precursor projects, a consortium headed by LieberLieber has now started to develop a cost-saving modeling and testing environment for safety-critical software systems as part of a EUROSTARS project. The intention is to develop a modeling environment within two years which will reduce the maintenance costs of critical systems by up to 50 percent. LieberLieber will coordinate the EUROSTARS project EMBEET (Environment for Model-Based Embedded Systems Engineering and Testing), part of the transnational Eurostar-2 call, over the next two years.

News ID 5172

MEN: high-speed gigabit Ethernet switch with extension cards on CompactPCI Serial

The G102 managed Ethernet switch is equipped with a 29 Gbit/s switch matrix, and provides up to 25 Gigabit Ethernet ports for high-speed communication. Three Gigabit Ethernet interfaces on X-coded M12 connectors, as well as a service access are available at the front panel. Various software protocols ensure data security, synchronous Ethernet, stable operation and temperature monitoring.

News ID 5098

More information about each news is available on www.Embedded-Control-Europe.com/magazine You just have to type in the "News ID". —

■ PEAK-System: CODESYS supports even more CAN and CAN FD interfaces

The automation software CODESYS from the company 3S-Smart Software Solutions supports even more CAN and CAN FD interfaces from PEAK-System. With the version CODESYS V3.5 SP10 released in December, the PCAN-Ethernet Gateway DR and the PCAN-Wireless Gateway DR can now be used with the CODESYS applications Gateway and Control Win V3.

News ID 5137

■ Solid Sands: SIG evaluates SuperTest quality as defined in ISO/IEC 25010 standard

Solid Sands announces that the Software Improvement Group, SIG, ranked SuperTest highest on coverage, maintainability and quality in a comparative study of compiler test suites used within the safety critical markets.

News ID 5157

■ Phaedrus Systems: SuperTest acknowledged as valuable test suite for compilers by SIG

Phaedrus Systems has announced that SuperTest test and validation suite for C and C++ compilers and libraries, from Solid Sands, has been ranked highest on coverage, maintainability and quality in a comparative study of compiler test suites used within the safety-critical markets. The evaluation was carried out by the Software Improvement Group (SIG) a specialist in evaluating software quality as defined by the ISO/IEC 25010 standard.

News ID 5158

■ Logic Technology: Datalight releases FlashFX Tera 4.1 with FreeRTOS support

Datalight has released the latest version of its FlashFX Tera product. This release introduces support for FreeRTOS, the popular operating system for micro-controller-based IoT devices, and the most recent versions of Linux. Designers of resource-constrained devices will also benefit from enhanced support for SPI NAND and SPI NOR.

News ID 5191

■ Green Hills announces Compiler 2017

Enhanced Performance and Programmer Productivity on All Leading Embedded Processor Architectures Including Applications Requiring ISO 26262 and IEC 61508 Functional Safety Certification Green Hills Software announced its latest Optimizing C and C++ Compilers for the world's most popular 32-bit and 64-bit embedded processor architectures, including ARM, Intel and Power Architecture. Enhanced support for the C++11 language, updated functional safety certification and NEON autovectorization lead the list of the many important compiler and toolchain enhancements.

News ID 5154

■ SEGGER: handheld programmer for in-field-services

SEGGER has announced the release of Flasher Portable PLUS, a compact unit using a rechargeable Li-Ion-battery to enable more than 10 hours of continuous, untethered stand-alone operation. It incorporates an LCD to display additional information on the programming process.

News ID 5164

■ EVT: new vision sensor for reading of pharmacodes

EVT presents a new vision sensor for reading pharmacodes also known as Pharmaceutical Binary Code: the EyeSens PharmaCode Reader (PCR). The pharmacode is a 7-digit numerical code for an unambiguous identification of pharmaceutical specialities and other products. The pharmacode can represent only a single integer from 3 to 131070.

News ID 5205

■ Teledyne LeCroy: 1 GHz oscilloscopes feature 10x oversampling up to 10 GS/s

Teledyne LeCroy introduces the HDO4000A, HDO6000A, HDO8000A, and MDA800A analog and mixed-signal oscilloscopes. These four high-definition oscilloscope product lines range from 200 MHz – 1 GHz bandwidth and utilize 12-bit HD4096 technology. All HDOs are ideal for debugging and troubleshooting power electronics, automotive electronics, and embedded/mechatronic designs with high-resolution sensor signals.

News ID 5187

■ Rohde & Schwarz: industrial security solution for secure Modbus protocol communication

Rohde & Schwarz Cybersecurity announced the availability of its new Modbus protocol detection and extraction capabilities provided by the deep packet inspection engine R&S PACE 2. The DPI engine delivers Modbus content and metadata extraction and enables IT security equipment vendors to gain full visibility of Modbus protocol communication in order to detect vulnerabilities and provide protection for the IIoT.

News ID 5230

■ Infineon: EtherCAT implementation in next to no time

The cost-efficient implementation of EtherCAT applications gets even easier – with Infineon's future-proof and application-optimized ARM-based microcontrollers and new development kits that help cutting down EtherCAT development time to three months. The XMC4300 Relax EtherCAT Kit and the XMC4800 EtherCAT Automation Kit passed the EtherCAT certification test and are available.

News ID 5130

■ IBASE: COM Express CPU module powered by Kaby Lake

IBASE presents its latest COM Express module supporting the 7th generation of Intel Core SoC processors. The new ET970 is built around the Intel CM238/QM175 chipset that provides a boost in I/O performance to match the benefits of the latest mobile Intel Core processors manufactured using the optimized 14-nm manufacturing process.

News ID 5207

■ SECO: broad range of Intel based solutions

The increasing complexity of connected machines and the quick development of IoT infrastructures require enhanced processing power and exceptional efficiency, as well as the ability of handling several tasks simultaneously. Believing in the amazing possibilities of the latest generations of Intel processors, SECO manufactures its Intel based products to fully meet these computational performance and energy efficiency needs, and conforming it to the most innovative and consolidated standard form factors.

News ID 5166

■ TME: bluetooth chips from Nordic Semiconductor

In the times of the dynamic development of the Internet of Things, more and more often wireless communication is one of the first prerequisites for electronic devices. Implementing such solutions on one's own can be troublesome and time-consuming. Therefore, it's reasonable to use readymade SoC products such as Nordic Semiconductor's nRF52 series.

News ID 5211

■ Logic Technology: TouchGFX 4.8.0 with new features and TouchGFX Designer

TouchGFX 4.8.0 has been optimized with our new GUI builder, TouchGFX Designer, along with useful enhancements that help you create innovative GUI applications with stunning graphics fast and easy. TouchGFX now includes our intuitive GUI builder tool, TouchGFX Designer, which flawlessly integrates into your TouchGFX development process.

News ID 5193

■ Manhattan Skyline: 10.1 inch Full HD TFT display

The GKIPA1MNHA1BO is a transmissive TFT with WUXGA resolution of 1920 x 1200. This model is comprised of a TFT -LCD module, a receiver circuit and a backlight unit. Graphics and texts can be displayed on a WUXGA 1920 x 3 x 1200 dots (16:10 aspect ratio) with 16.7M colours by supplying 24bits data (8 bits per colour), 2 channel LVDS receiver 8 bit interface.

News ID 5162

Pentair: more performance for network function virtualization

Pentair is actively working on the definition, specification and introduction of new technologies and has been heavily involved in the specification and implementation of AdvancedTCA, the standard for high-performance communications blade servers. The same thing is now happening with the next generation of follow-up technology, 5G network infrastructure.

News ID 5192

TME: PIC18F MCUs from K40 series come with extensive set of peripherals

The new 8-bit PIC18F microcontrollers from K40 series manufactured by Microchip Technology have a wide range of applications. In some electronic devices, they can successfully replace more complex and having more computing power 32-bit microcontrollers with ARM architecture. The new family includes ten models equipped with 16-128kB FLASH memory.

News ID 5117

Rutronik expanding in the United Kingdom

Rutronik Elektronische Bauelemente is expanding its team in the United Kingdom and is opening another office to boost the existing presence in Bolton, near Manchester. The new Rutronik Office in Swindon officially opened on 10 April 2017, and 14 field sales staff will be serving existing and potential customers in the south of the country from here. Around 60 per cent of the DTAM in the UK and Ireland is attributable to the south of England.

News ID 5234

Pentair: configurable solutions to reduce development costs and time

Pentair has developed a new concept which enables design engineers to quickly create customized solutions to house and protect their small form factor boards, while minimizing development costs and lead time. Using a modular approach design, engineers can specify their enclosure, cooling, peripheral components, and mounting method based on the needs of their specific application. Each building block can easily be configured and combined, resulting in a customized solution ready for manufacture.

News ID 5153

PICMG: ratification of COM0 R.3 for COM Express for server grade performance

PICMG released a high-performance revision that adds server-grade functionality to COM Express embedded computing systems. COM Express is widely used in Industrial Automation, Military/Aerospace, Gaming, Medical, Transportation, IoT, and other applications.

News ID 5200

Rohde & Schwarz: entry-level oscilloscope with 10-bit vertical resolution and touchscreen

Rohde & Schwarz broadens its growing oscilloscope portfolio with the R&S RTB2000, the first low cost oscilloscope to offer touchscreen operation as well as 10-bit vertical resolution. For most of the last three decades, oscilloscopes have predominantly offered 8 bits of vertical resolution, which allows a signal to be mapped to one of 256 vertical positions.

News ID 5150

PEAK-System: CAN FD adapter for dirty applications

After the PCAN-USB X6 with D-Sub connectors, PEAK-System brings new versions of the CAN FD adapter on the market and reacts to the growing demand for circular connectors. The PCAN-USB X6 with M12 circular connectors is the company's first CAN FD interface for use in harsh environments.

News ID 5196

ARBOR: Qseven CPU module in Pentium / Celeron processor version

ARBOR Technology announces the immediate availability of the EmQ-i2401 Qseven module, based on the new Intel Pentium / Celeron processors. Based on this new premium class low-power design, the robust Qseven modules consume, on average, just 6 watts while providing increased graphics capabilities and overall performance. Up to 12 graphics execution units can support up to three HD displays or two 4k displays. The modules support Intel Advanced Encryption Standard New Instructions set, which is more relevant than ever in practical application.

News ID 5215

Wibu-Systems: smallest dongle with flash memory

CmStick/CM, the newcomer to CodeMeter's hardware element family for secure key storage, comes in a futuristic design that is not just elegant, slim, and ultra-compact in size, but also the outcome of a totally new way of creating robust USB devices made to stand up to even demanding industrial environments.

News ID 5181

Apacer: cable-less power multi-PowerPath SSD

Apacer Technology has introduced its latest SATA Disk Module: the SDM7-M DP – a miniature MLC SSD which has won the 2017 Taiwan Excellence Award. Successfully combining rigid and flex boards, the SDM7-M DP is compact, thin and light, simplifying the system structure for design flexibility. Supporting SATA3 (6Gb/s), it can reach up to 525MB/s and 350MB/s in read/write speed, making it the fastest miniature module in the industry.

News ID 5178

boards & solutions ECE

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■ Xilinx: Virtex UltraScale+ FPGAs available in Amazon EC2 F1 Instances

Xilinx announced that its Virtex UltraScale+ FPGAs are available in Amazon Elastic Compute Cloud (Amazon EC2) F1 instances. This instance provides programmable hardware acceleration with FPGAs and enables users to optimize their compute resources for the unique requirements of their workloads.

News ID 5228

■ acceed: Modbus/TCP module for 3 temperature sensors

Artila is known worldwide as a developer of cost-efficient remote IO modules. Now, the manufacturer has introduced a new device, the RIO-2018 to the market, which is in particular characterised by its three thermodynamic data channels. Either type J (-210 … 1200 °C) or K (200 … 1350 °C) thermal elements can be connected to it. The new remote module is available from the German distributor acceed, known as an embedded systems specialist.

News ID 5206

■ VadaTech expands DAQ Series product range in MTCA.4

VadaTech announces expansion of the DAQ Series product range in MTCA.4. The DAQ523 provides 12 channels of ADC (AD9653) with 2 channels of DAC (MAX5878) coupled to Xilinx Kintex-7 XC7K410T FPGA and now has options for programmable gain and AC/DC selection, and for optical detection in the 1310 to 1650 nm range.

News ID 5201

■ iesy: BeagleCore BCM1.ETR extended temperature range version

BeagleCore announced its brand-new BeagleCore BCM1.ETR module catering to industrial needs by supporting an extended temperature range. With only 48 × 31 × 3.5 mm in size the BeagleCore module is designed to be a soldering module based on Land Grid Array. This makes the connection very reliable and cost effective. From May 2017 on the BeagleCore BCM1.ETR module will be exclusively sold through Conrad Electronics.

News ID 5229

■ b-plus: automotive data recorder for multi sensor

The recording software AVETO.rec (Automotive Validation Toolchain) is specifically tailored to sensors and control systems of future driver assistance systems and autonomous systems. It has the ability to handle the bandwidths demand of tomorrow's sensors and ECUS. Reliable data decoupling, data integrity and time synchronization combined with high performance and an easy-to-use web interface.

News ID 5167

■ Kontron: SMARC Evaluation Carrier 2.0 comes with high number of ports

Kontron has introduced the SMARC Evaluation Carrier 2.0 for ultra low power Computer-on-Modules. Facilitating the development of embedded applications based on the SMARC 2.0 platform, it gives users a head start in their system design and flexibility to create individual solutions. The SMARC Evaluation Carrier is based on the current SMARC Design Guide version 2.0, which was developed under significant involvement of Kontron and only recently introduced by the Standardization Group for Embedded Technologies.

News ID 5144

■ acceed: industrial switch with PoE and M12 according to EN 50155

The industrial switch TGPS-1080-M12 has eight 10/100/1000Base-T(X) interfaces realised as M12 connectors. The switch meets the requirements in accordance with EN 50155 for electronics in rail vehicles and can therefore withstand the tough requirements regarding the ambient temperature, humidity, soiling, vibration, voltage fluctuation, cooling and electromagnetic compatibility.

News ID 5118

■ Portwell: compact COM Express module with Kaby Lake-U

Portwell released the PCOM-B644VG, a COM Express Type 6 Compact Module based on the 7th Generation Intel Core ultra-low power processor. This module includes Intel Turbo Boost Technology for faster processing, Intel vPro Technology for superior remote capabilities and Intel Hyperthreading Technology for multithreading.

News ID 5186

■ TQ makes it easy to develop industrial routers and gateways

TQ presents a new concept for a minimodule. The TQMLS1012A module, based on NXP Semiconductor's new 64 bit Cortex A53 QorIQ Layerscape processor family, is outstandingly suited for robust routers and gateways that are used in an industrial environment. This module is to be developed in a purely LGA version with a very small footprint of 31x31 mm².

News ID 5139

■ Vecow: 4-port 10 GigE workstation-grade Embedded system

Vecow launches the first embedded box PC featuring 4-port independent 10 GigE RJ45/SFP+ connections in the market, ECS-9755/9771 Series Embedded System. Powered by workstation-grade Intel Xeon processor, 6 independent GigE LAN with 4-port IEEE 802.3at PoE+, 4-port 10 GigE LAN for up to 10Gbps data rate, all-in-one integrated features, multiple I/O connection, user-friendly, smart manageability, leading workstation-grade system performance, excellent mobile availability, 6V to 36V power input with 80V Surge Protection.

News ID 5159

■ Lanner: F.A.S.T. supporting 1G/10G/40G/100G Ethernet speeds

F.A.S.T. solutions are purpose-built developed for enhancing Lanner's high-end network computing appliances. The multi-functional modular kits come in the N2S, the N3S or the NCS2 form factor and aim to deliver flexibility, adaptability, scalability and transformability for all compatible appliances' connectivity, storage and open compute capabilities.

News ID 5236

■ b-plus: compact PC platform for automotive applications

The DATALynx mITX2, based on a Q170 mITX motherboard for Intel Socket 1151 desktop processors of the 6th and 7th generation Intel Core family, is a reliable, robust compact computer for computer-intensive applications and logging in automotive environments at operating temperatures of -10 to + 50 °C. The optional b-plus ethernet time sync extension allows several systems to be set in temporal correlation based on IEEE 802.1AS.

News ID 5171

Advertisers Index

AAEON: compact, high-performance network appliance with Kaby Lake

AAEON announce the powerful, flexible, and composable FWS-7821. The FWS-7821 builds upon the FWS pedigree as the next generation of easy to manage, rapidly deployable, intelligent security appliances featuring IPMI, TPM, Unified Threat Management, and Intrusion Detection & Prevention.

News ID 5173

SECO: roadmap from NXP i.MX 6 to i.MX 8M

Amongst the most important innovations, SECO introduces an updated version of its Q7-928, a Qseven standard module featuring the NXP i.MX 6 DualPlus applications processor that offers top computational and graphical performances given by the low-power consuming ARM architecture. The i.MX 6 DualPlus processor is also an option for the SBC-A62-J, a low-end SBC that exploits the potential of a configurable expansion connector to fully meet the configuration flexibility needs.

News ID 5175

ADL: rugged chassis system designed for MIL-STD 810 environments

ADL Embedded Solutions has announced its latest rugged chassis system, the ADLMES9200. This successor to ADL's popular ADLMES8200 rugged chassis is now IP67-rated with lower weight, lower cost and more reliable EMC-compliant gasket interfaces for robust military and rugged industrial applications.

News ID 5176

TQ: next generation ARM Cortex modules

TQ presents its module concepts based on the i.MX8 series of CPUs at embedded world 2017. The i.MX8 CPUs, based on three different Cortex Axx architectures with differing market orientations, already show the promise of trend-setting solutions. The individual CPU versions have differing specifications and support CAN FD, USB 3.0 and audio. In addition, they exhibit very high graphical performance (4K video, 3D graphics).

News ID 5106

Nexperia: EMI and ESD protection for USB 3.1 Type C, HDMI 2.0 and MIPI M-PHY systems

Nexperia announced three new series of common mode EMI filters with integrated ESD protection: PCMFxUSB3S, PCMFxHDMI2S and PESDxUSB3S, which provide support for USB 3.1 Type C, HDMI 2.0 and MIPI M-PHY interfaces. Using the same footprint, Nexperia's TrEOS ESD protection diodes are offered in the same package. System engineers will benefit from having a single device instead of two (common mode filter plus TrEOS ESD protection component) saving PCB space and improving reliability and design flexibility.

News ID 5146

Altreonic: VirtuosoNext Designer implements fine grain space and time partitioning

Altreonic has now ported VirtuosoNext Designer to the Freescale QorIQ T2080/1 processor. The chip has 8 floating point cores implemented as 4 CPUs with a dual register set running at 1.8 GHz. The latest port of VirtuosoNext Designer delivers unprecedented hard real-time capability in the microsecond range in combination with fine grain task level space and time partitioning for embedded safety-critical applications.

News ID 5113

Atlantik: LTE Cat 1 module supports MIMO technology

Atlantik Elektronik presents the 4G LTE Cat 1 module EG91 from Quectel for wireless M2M communication, which will be a strong support for the IoT. Atlantik Elektronik introduces with the EG91 from Quectel another LTE mobile module of Cat 1 category, which is suitable for M2M and IoT applications due to its industrial temperature range of -40 to + 85°.

News ID 5165

congatec: COM Express modules with Kaby Lake processors

congatec has released new COM Express Compact modules in time with the launch of the 7th generation of Intel Core SoC processors. The new COM Express computer modules support Intel Optane memory which is based on 3D XPoint technology. Compared to NAND SSDs, it offers significantly lower latency yet is capable of handling the same size of data packets.

News ID 5108

Artesyn extends SIL4 COTS rail computing platform to onboard applications

Artesyn Embedded Technologies has unveiled the latest in its portfolio of SIL4 COTS computing systems for rail safety applications, the ControlSafe Carborne Platform. Designed for onboard applications such as automatic train protection, automatic train operation, and positive train control, the new platform can also be used in wayside train control and rail signaling implementations.

News ID 5217

Premier Farnell: global franchise agreement with Dialog Semiconductor

Premier Farnell announce a new global franchise agreement with Dialog Semiconductor. The agreement further enhances Premier Farnell's semiconductor power management and wireless product ranges. Dialog Semiconductor products offer high performance power saving solutions, particularly for smartphones, power adapters, solid state lighting and emerging IoT applications.

News ID 5242

Eurotech: new designs feature 2nd gen Intel Xeon Phi and Atom E39XX

Eurotech announces the two new designs that further expand its portfolio of Intel-based products. The new E39xx boards and modules will be available both in standard form factors (COM Express Type 10) and in the enhanced Eurotech Catalyst small form factor. The new products target industrial and rugged applications, where extended temperature, conformal coating, extended lifecycle are essential features.

News ID 5190

ICP: visualization in a fanless and slim 5:4 format

ICP Deutschland expands its proven touch panel PC series to the display size of 19 inch. The classic 5:4 format of the fanless Bay Trail PPC-F19 with a resolution of 1280x1024 facilitates an easy replacement of older systems. The small mounting depth of 53mm results in a slim design that enables multiple mounting possibilities such as wall, panel, rack or arm mounting.

News ID 5204

Portwell: COM Express type 6 basic module for medical healthcare and retail systems

Portwell released the PCOM-B643VG, a COM Express Type 6 Basic Module based on the 7th Generation Intel Core mobile processor and Intel QM175 and CM238 express chipset. This module includes Intel Turbo Boost Technology for faster processing, Intel vPro Technology for superior remote capabilities and Intel Hyper-threading Technology for multi-threading.

News ID 5182

Vector Software introduces VectorCAST/Probe

Vector Software announced VectorCAST/Probe, providing a simple way to dynamically instrument an application with blocks of code to enable white box testing, inject faults, and debug hard to repeat race conditions. VectorCAST/Probe supports multiple platforms and is integrated with the full family of VectorCAST tools for unit testing, system testing and integration testing.

News ID 5126

MEN: robust multi I/O board for railway applications

The CompactPCI board F405 is a multi I/O board designed specifically for use in railway applications. Thanks to the extended voltage range of -110 V to +110 V, the card can be used worldwide and in many different ways. In addition, the FPGA based design ensures long-term availability for the application.

News ID 5225

ADLINK
Leading EDGE COMPUTING

Building Blocks for improved Industrial IoT

LEC-AL

SMARC® Short Size Module with Intel® Atom E3900 Series, Pentium™ N4200 or Celeron™ N3350 Processor

- Up to 8 GB DDR3L at 1867 MT/s
- Triple display support
- HDMI/DP++, DP++, Dual channel LVDS (18/24-bit)
- 2x MIPI CSI camera (2/4 lanes)
- 1x GbE with IEEE1588
- 1x SATA 3.0, onboard eMMC

Express-KL/KLE

COM Express Basic Size Type 6 Module with 7th Gen Intel® Core™ and Intel® Xeon® Processors

- 32 GB Dual Channel DDR4 at 2133/2400 MHz
- 3x DDI channels, 1x LVDS (or eDP), 3 independent displays
- 8x PCIe x1 (Gen3) and 1x PCIe x16 (Gen3)
- GbE, 4x SATA 6 Gb/s, 4x USB 3.0 and 4x USB 2.0
- Featuring SEMA® for easy integration of Hardware monitoring and control
- Extreme Rugged operating temperature: -40°C to +85°C

Express-BD7

COM Express Basic Size Type 7 Module with Up to 16 cores Intel® Xeon D and Pentium® D SoC

- Up to 16 cores Intel® Xeon D Series SoC
- 32 GB Dual Channel DDR4 at 2133/2400 MHz
- 2 x 10GbE+ GbE and NC-SI
- Up to 32 PCIe lanes
- GbE, 2xSATA 6 Gb/s, 4x USB 3.0/2.0
- Featuring SEMA® for easy integration of Hardware monitoring and control
- Extreme Rugged operating temperature: -40°C to +85°C

MXE-110i

Intel® Quark™ Processor-Based Industrial IoT Gateway

- Intel® Quark™ SoC X1021
- Extremely compact: 120 mm (W) x 100 mm (D) x 50 mm (H)
- Full support Intel® IoT Gateway, with pre-loaded Wind River® IDP XT 3.1
- 2x USB 2.0, 2x 10/100 MbE
- 2x mPCIe slots, 1x USIM slot
- 2x COM ports (RS-232, RS-232/422/485)
- Built-in ADLINK SEMA Management Utility

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